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● After Hours:  
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Planning a Breeze

**FIRST LOOKS:**

- Palm V and Palm IIIx
- First Internet Bank
- Sony VAIO Slimtop
- Aladdin FlashBack™ And GoBack
- Epson Stylus Color 900
- Microservers from Cobalt, Corel, and WindDance



THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.7 APRIL 6, 1999

# THE YEAR 2000 COUNTDOWN

**Critical Steps  
To Prepare for the  
New Millennium**







## **HERE'S A WAY TO GET YOUR 90-HOUR WORK WEEK DOWN TO 81.**

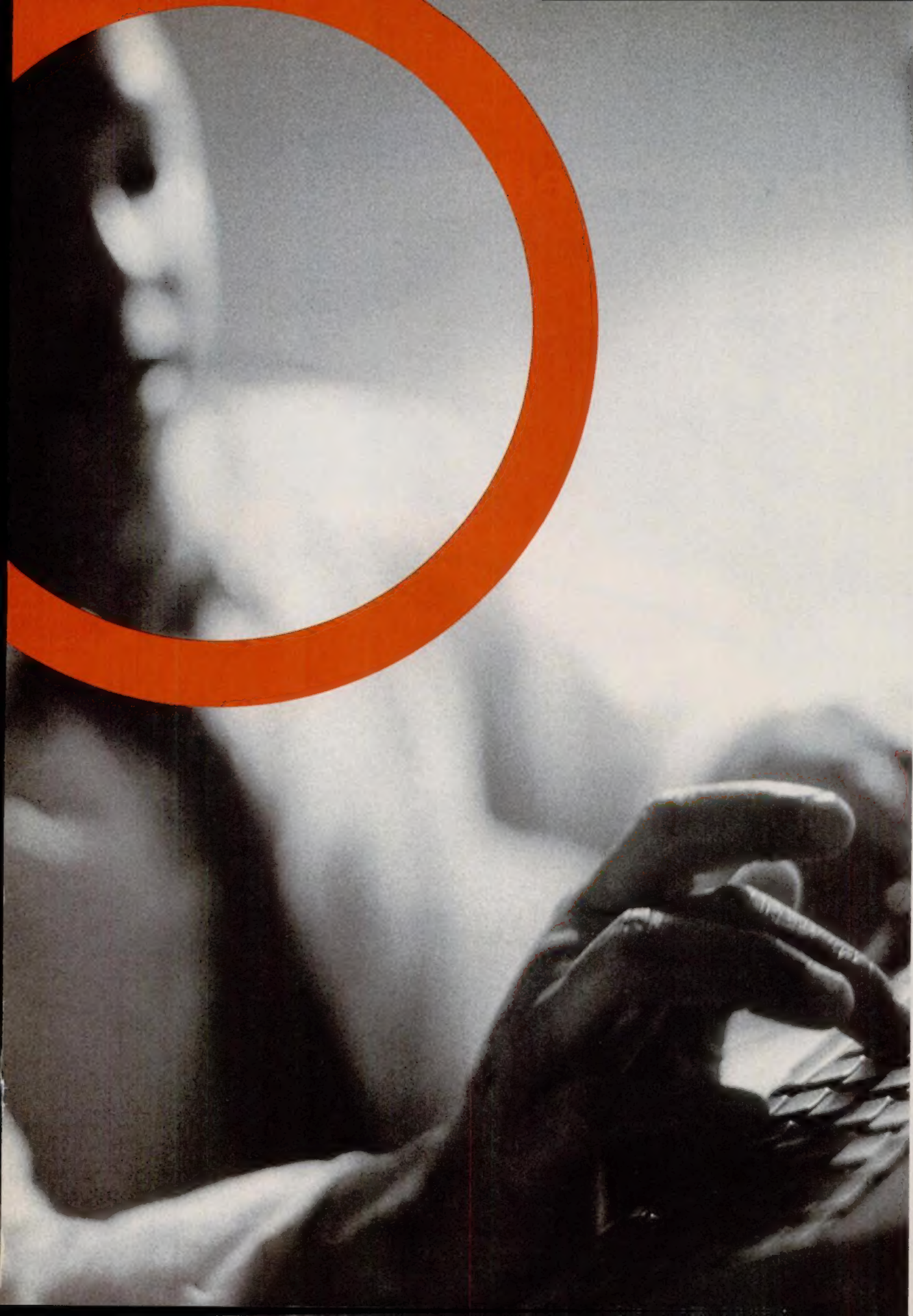
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## Why Y2K Is Good for You

Lately it seems as though my mailbox is overflowing with comments on the year 2000 problem, the so-called millennium bug. It's no surprise that a lot of people have concerns; what is surprising, though, is the depth of passion that many people feel about the issue. A number of readers feel that *PC Magazine*

and I have been far too sanguine about the Y2K problem, despite the stories we've published, including last October's cover story on the topic. They believe that the world is coming to an end, and we're just ignoring the problem.

On the other hand, I get several press releases a week from vendors who claim to have *the* solution. Just run our product, each vendor says, and all your Y2K issues will disappear. Right. Many of these products do something useful, but I'm skeptical that any single product is a magic bullet.

On the Y2K doomsday scale, I'm pretty much an optimist, as I've said before. I don't expect that the power will go out and never come back on. I'm not gathering years' worth of food, guns, and ammunition. And I don't think it will mean "the end of the world as we know it," as doomsayers predict.

So brand me as positive: I have faith that most large businesses, at least in the U.S., will fix or replace their business-critical systems. Most small businesses will either fix their problems or find them minor enough to live with. The federal government will get its critical systems working reasonably well. And the power systems in most places will work fine; those places that do have problems will likely have only very short outages.

But I don't want to sound like Pollyanna here. None of this means that there won't be any problems or that running some simple software program will fix everything. No matter how much gets done, there will be dilemmas. Some systems won't be upgraded in time. Some processors and some machines will stop working. Some businesses won't get the job done and will suffer big financial losses.

I'm particularly worried about small government agencies, some embedded systems, and problems in developing nations.

But I'm most worried about the possibility of Y2K panic. Just wait: We've already seen an oversaturation

of media coverage discussing Y2K problems and sounding as if there's nothing we can do. More stories are likely the closer we get to 2000. For instance, April 9, 1999 (the 99th day of 1999), is just around the corner, and some problems are bound to occur. Ditto for September 9, 1999. Y2K is likely to provide the scenario for an action movie or two before the year ends.

Some people would have you think that your only choice for dealing with Y2K is either to panic or to sit quietly and watch whatever happens. But that's not true. Each of us individually can take steps to protect ourselves, our businesses, and our communities. We outline ten steps you can take in our cover story this issue ("Y2K Countdown," page 100). And I am convinced that if we all do our parts we can get through this without too much trouble.

In fact, in the long run, Y2K may actually be good for us. The crisis is causing each business and government agency to take stock of what computer systems it has and what steps to take to correct any problems. Many companies are finally getting around to replacing systems that have been outdated for years. Others are putting good backup solutions in place. And many are finally

documenting processes and systems that have been fragmented for years.

As individuals, Y2K may cause us to think more about the data we depend on, the technology we use, the information we need, and how we store that information. To the extent that people prepare for a Y2K disaster, they'll be better prepared for any other kind of emergency, from technological breakdowns to acts of nature. In short, Y2K may give us all more robust, more orderly technology, and that's a good thing.

So don't panic. Figure out what you can do to prevent or minimize the effect the Y2K problem has on you, your business, and your family. This probably won't be the end of the world as we know it. But if we do what we can, we can still feel fine. **PC**

**Y2K may cause us to think more about the data we depend on, the technology we use, and how we store information.**



### More on the Web:

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Michael J. Miller  
answers your computing  
questions every Tuesday,  
exclusively at *PC*  
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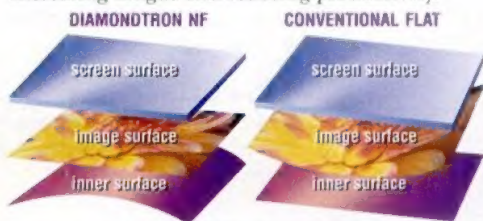
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For more information contact Mitsubishi Electronics today.



April 1999

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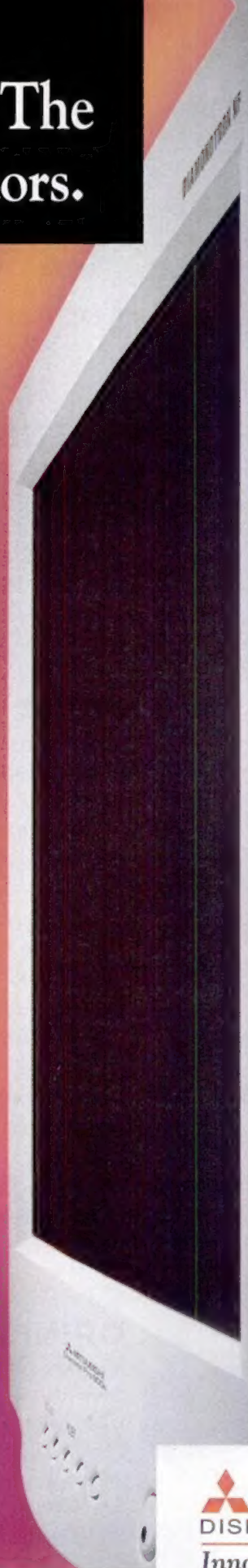


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*Innovation On Display<sub>SM</sub>*



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Cover photography: Thom O'Connor

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More online at  
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## See DV Camera Output

How well do the digital video cameras we tested in this issue really perform? See for yourself by downloading our sample files.

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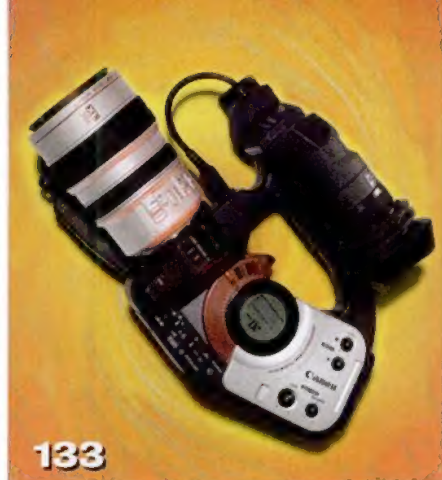
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## 100 Y2K Countdown

As the new millennium nears, it pays to be prepared. Our Y2K checklist identifies pitfalls and outlines contingency plans so you won't be caught off guard. *By Jim Seymour*

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Thanks to the Web, digital video cameras are more popular and affordable than ever. We test ten entry-level models and explain when they're worth the investment. *By Jan Ozer*

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Building a Web presence for your company is easier—and cheaper—than you think. Here are 13 Web sites designed to help you build a Web presence or virtual community for free. *By Doug Beizer*

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PC Magazine Labs tested 11 networking kits and discovered that you don't need to be an IT professional to wire your home or office. You *can* do it yourself. *By Les Freed and M. David Stone*

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Show your digital-camera images on your TV with the Avicor Digital Photo Album.

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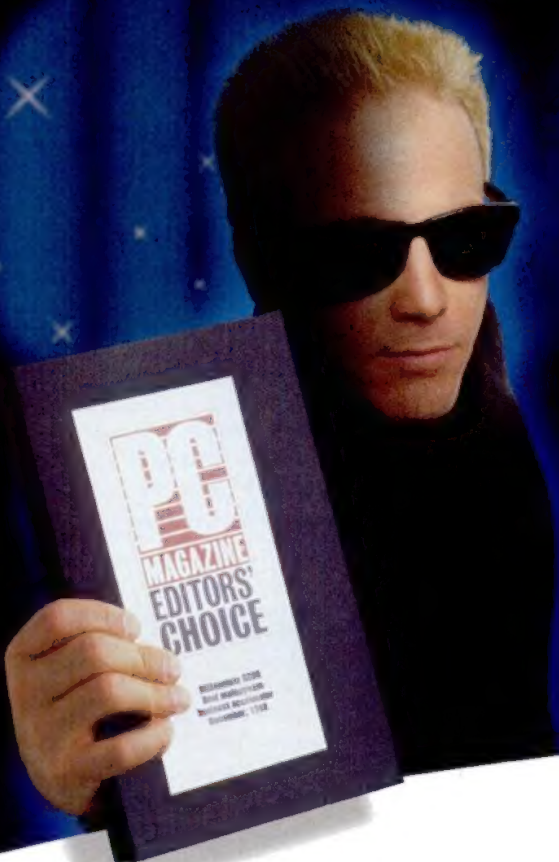
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## "Best business accelerator"

### Matrox Millennium G200

**Millennium G200**  
Best mainstream  
business accelerator  
December 1998



Whether you're looking to upgrade your current PC with a Matrox video card or to purchase Matrox as an integrated component in today's advanced, next generation PCs, you're guaranteed award-winning performance at a new, low price.

**Compaq Desktop EN 450**  
Model 6450X/1400/CDS  
with Millennium G200 SD  
Best high end corporate PC  
December 1998



## "Best high end corporate PCs"

### Compaq Deskpro EN 450 and HP Vectra VL Series 8 HE

**Vectra VL Series 8 HE**  
with MGA-G200  
Best high end corporate PC  
October 1998



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**HP Vectra VE Series 8**  
with Productiva G100  
Best mainstream corporate PC  
December 1998



## "Best mainstream corporate PC"

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#### 2D performance

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The tests were performed without independent verification by Ziff-Davis. Ziff-Davis makes no representations or warranties as to the result of the tests. WinBench, 3D WinBench and WinMark are trademarks of Ziff-Davis Inc. in the US and other countries. All tests performed with Windows 98 on an Intel 440BX motherboard configured with a 400MHz Pentium II and 128MB of 100MHz SDRAM. WinBench 99 Business run at 1280x1024x24bpp@75Hz refresh. 3D WinBench 99 run at 1024x768x16bpp triple buffered with 16bit Z at 85Hz refresh under DirectX 6.0. Matrox Millennium G200 configured with 8MB of SGRAM for the AGP bus and using driver revision 4.50.

# matrox



## Plastic Displays

**E**very road warrior's worst nightmare: You drop your notebook on the ground, pick it up, and get a blank screen, a cracked screen, or a distorted image at best. But turn the dream upside down. You drop your notebook on the ground, pick it up, and just keep on working. A new development in plastic thin-film transistor (TFT) research may bring durable and flexible screens to your notebook soon.

Conventional TFTs are manufactured onto a rigid glass substrate, but new techniques call for making the transistors on flexible plastic. In recent tests, pentacene (a form of plastic) transistors have rivaled the performance of the silicon transistors used in current notebook screens. But in order to achieve these results, the TFTs require 100 watts of voltage, which is far too taxing for a notebook's battery. Overcoming the heat problem has been a great technical challenge, because plastic can't withstand high heat without deforming.

To tackle this problem, scientists at IBM Research recently replaced a transistor's silicon dioxide insulator with another insulating material—barium zirconate titanate (BZT)—and brought down the voltage to a manageable 5 watts.

Christos Dimitrakopoulos, the project chief, says that IBM has taken a major step toward creating lightweight, flexible active-matrix displays for notebooks. "All the processing steps can be done at room temperature, so you can make it on any plastic," he says.

Plastic transistors may also be used for thin, flexible instrument panels that wrap around your windshield, as well as for disposable smart cards that serve your transitory data needs. Researchers expect the first prototypes to be ready within the next five to ten years.

## Digital Photos Without a PC

**F**or digital cameras to gain widespread acceptance, people will have to be able to use them without a PC. That day isn't far off, because photo-lab equipment manufacturers Konica, Agfa, Fuji, Noritsu, and Gretag are starting to supply photo-finishers with equipment for printing pictures from any digital media as easily as from film. The Fuji Aladdin Digital Picture Center will let you insert your digital memory card into a kiosk, choose which pictures you want printed, and print sheets of various-size photos just as a portrait studio would. These machines promise to print higher quality images cheaper and faster than you could do with your PC and color ink jet printer.



of respondents to a recent PC Magazine Online poll told us they haven't tried online auctions but will likely give them a go sometime in the future. 29 percent said they enjoy auctions, 10 percent said they tried them and didn't like them, and 27 percent said they have no interest in participating.

## Charitable Transactions

**M**ost people have charitable urges. They volunteer, they donate, they help. Often, though, the bustle of everyday life gets in the way. Many people want to support their favorite causes but feel that they just don't have the time or the energy, or perhaps even the financial freedom to do so. But suppose there was a way to donate to charity by just doing what you normally do?

not-for-profit organizations. Customers shop as they normally would and pay regular prices, but at least 5



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**Y2K: The  
Countdown  
Continues**

PC Magazine's online coverage of year 2000 continues with our one-stop guide and ZDNet's special report. Test your own PC.

**Do You Get  
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Stop by our home page, and sign up for our newsletter, featuring insight from Bill Machrone.

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Download**

Our shareware experts scour the ZDNet Software Library every day to bring you a notable pick.

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Every Monday**

Check in with our cantankerous columnist each week for his news, views, and snide asides.

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Remember that all the Editors' Hot Links you see in PC Magazine evaluations are easily accessible from our Web site.







## Dick Tracy's Watch

**T**he recent Demo 99 conference in Indian Wells, California, was, as usual, a showcase for all kinds of cutting-edge new products. This year, Web collaboration software and slick gadgets took center stage.

Among the slickest of the gadgets was NTT's wrist phone, which is designed to replace your cellular phone. Worn like a watch, the wrist phone uses low-cost, wireless communication technology currently in use by over 6 million people in Japan. It works like a cellular phone when you're not in range of your base station. When you're within range, then a "local" call to another unit in range avoids wireless charges.

The wrist phone could become a handy device around corporate campuses and hospitals. With high-quality voice recognition and 32- or 64-Kbps data throughput, this \$400 device is a serious contender for those seeking techno-geek road-warrior status. It won't be available until later this year, but don't be surprised if you see a colleague talking to his wrist.

## Chameleon: It's a Concept

**R**esearchers at IBM recently trotted out a prototype that takes computer design to a new level—several new levels, in fact. The hybrid notebook/desktop, code-named Chameleon, combines the portability of a notebook with the audio and video capabilities of a desktop. The unit can be set up in several positions: closed, for carrying (A); traditional notebook style (B); touch-screen kiosk mode, in which the keyboard is used wirelessly (C) or is hidden (D); or tablet mode (E), in which the display swings out flat for drawing or using as a message board. These images are computer-generated renderings of one industrial design that IBM is now exploring.

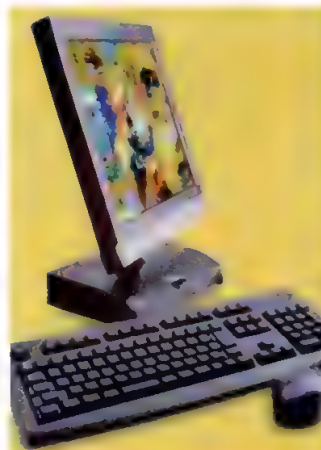


THIS ISSUE'S CONTRIBUTORS: Ben Z. Gottesman, Carol Levin, Sharon Nash, Sebastian Rupley, Don Willmott.

## Desktops on A Diet

**T**he move toward smaller computing devices is raging in the display and hand-held PC arenas, where flat-panels are taking up less space than traditional monitors and palm-size devices are gaining popularity.

NEC recently debuted a new approach to desktop computing that continues the "devices on a diet" trend. By leveraging its experience with notebooks, the company has developed the NEC Millennium, a tiny desktop PC with a flat-panel monitor. With PC Card slots, this power-



THE NEC Millennium: 10.5 by 7.7 inches.

house is about the size of a notebook PC but contains the best of today's technology. It's not clear what the exact specifications will be, but the tiny desktops will be priced under \$2,000, and they should be available in July.

## Top-Selling Retail Desktops

|    |                                         |
|----|-----------------------------------------|
| 1  | IBM PC 300GL/350 (\$1,079)              |
| 2  | Compaq Deskpro FM/350 (\$1,252)         |
| 3  | IBM PC 300PL/350 (\$1,283)              |
| 4  | Compaq Presario 3170/350 (\$1,260)      |
| 5  | Apple iMac 233 (\$1,198)                |
| 6  | Compaq Deskpro FM/400 (\$1,460)         |
| 7  | Compaq Presario 2266/300 (\$677)        |
| 8  | Compaq Presario 5150/350 (\$1,053)      |
| 9  | Compaq Presario 5050/333 (\$861)        |
| 10 | Packard Bell Multimedia 955/333 (\$782) |

Source: IDC eVestment Intelligence  
Data for January 1999.

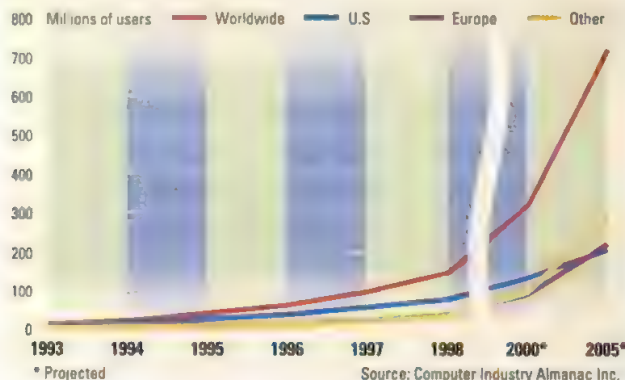
## Big Business

Retail and entertainment Web sites make up half of all online business sites, according to new data from market researchers at ActivMedia. Average monthly sales revenues (among retail sites that generated revenues) have risen to \$40,273, up from \$13,620 at the same point in 1997. That's a 200 percent increase in one year.

Notably, the Web isn't as effective a sales medium in the low-end. Less than 2 percent of all retail sites sell products costing less than \$10, but about a third of retail sites sell products costing \$100 to \$1,000.

## Web Growth Spurt

Within the next few years, the most dramatic increase in the Web's population will be in Europe. Growth in the U.S. is expected to slow as the market matures.





**Oracle Express analyzes 50 times**

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|                    | <i>Data Density</i> | <i>Query Execution Time</i> |
|--------------------|---------------------|-----------------------------|
| Oracle Express 6.1 | 5.0                 | 0:34:02                     |
| Hyperion Essbase 5 | 0.1                 | 0:36:30                     |



In a recent industry standard OLAP council benchmark, Oracle Express<sup>®</sup> ran 250,000 queries against a data density of 5.0 and delivered an average response time of 0.07043 seconds. That's 50 times more data than the previous record

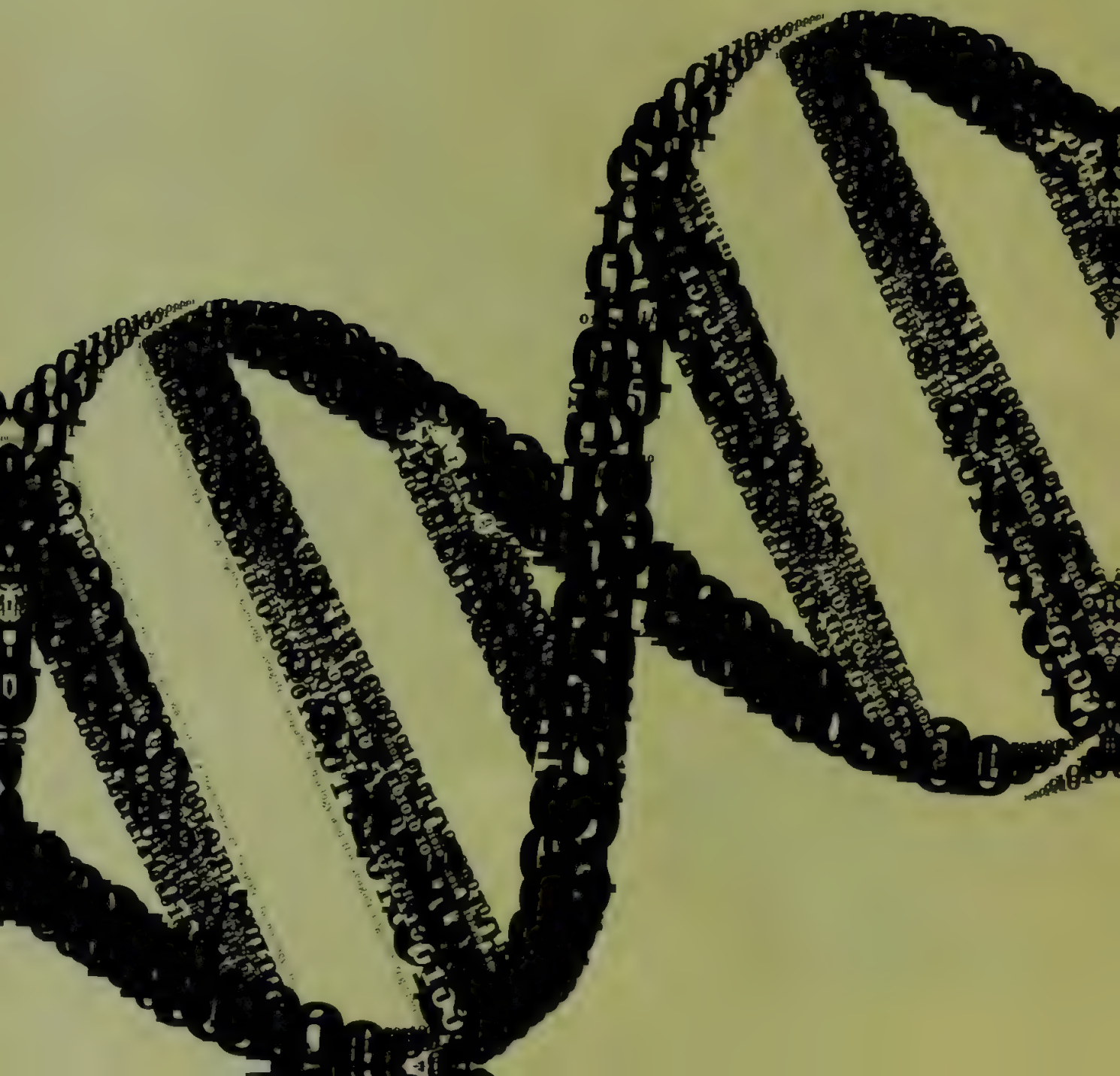
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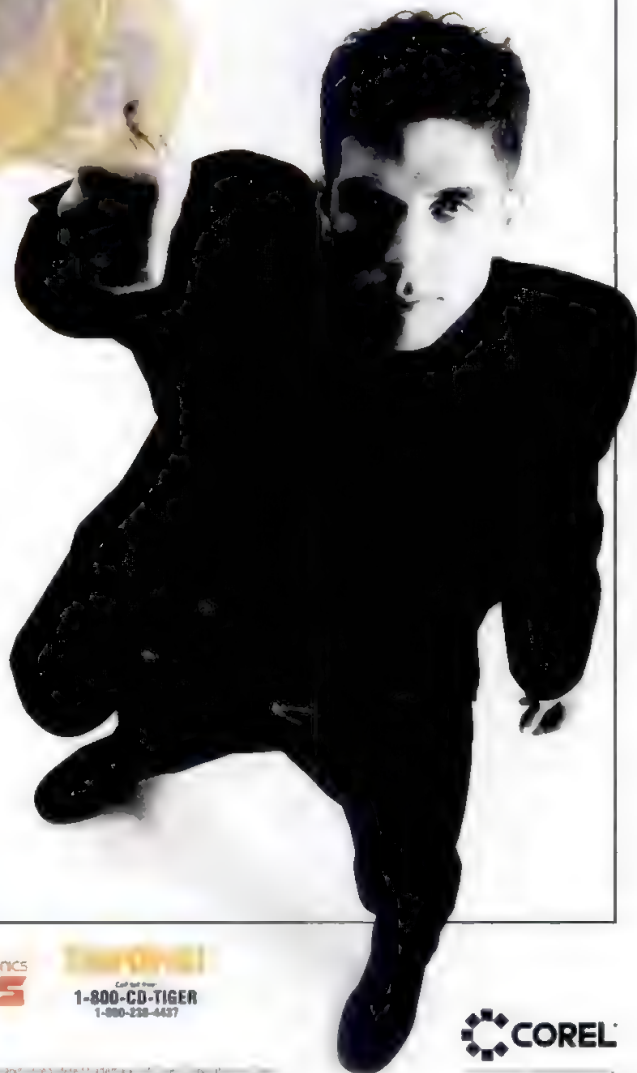
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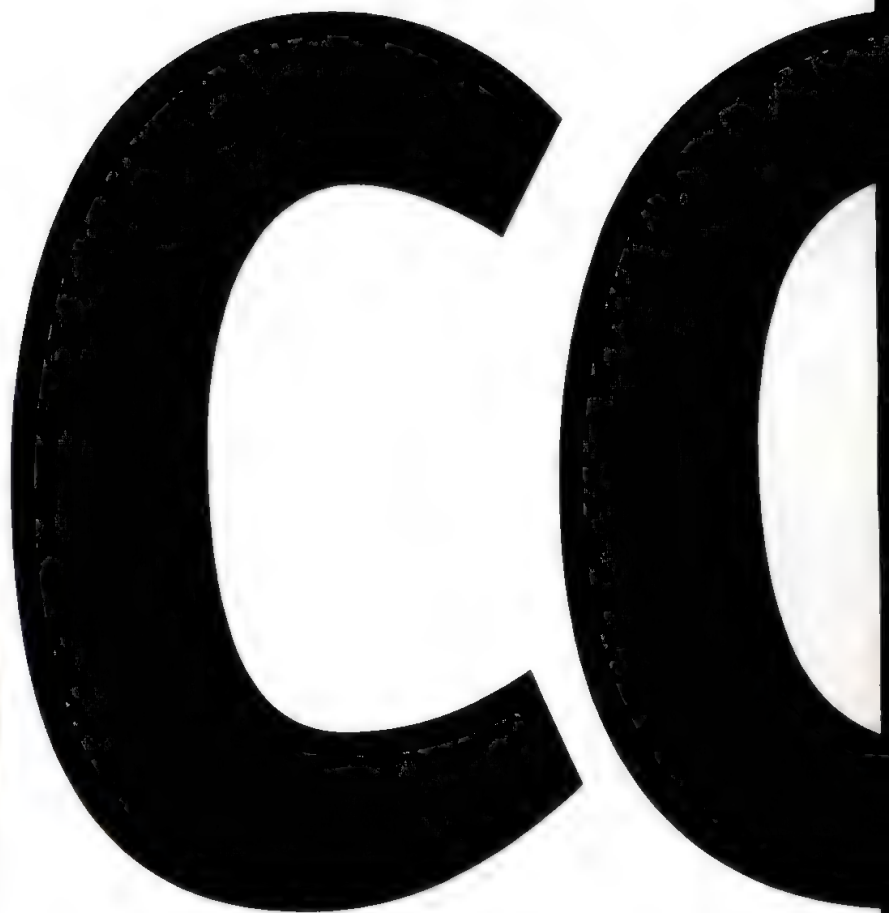
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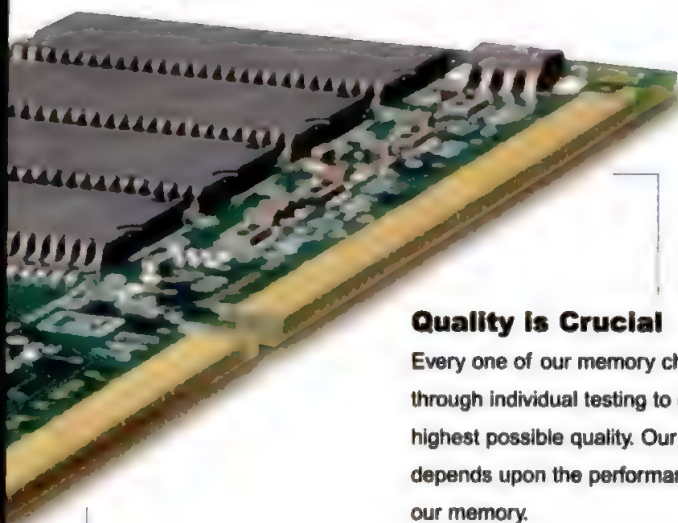
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# LETTERS

## ON THE LEVEL

Regarding "The Newest Value Notebooks" (February 23, 1999): The main focus seemed to be getting the most for your money with a notebook computer, and I think the story did a very good job in that respect. But I have an issue with the testing process. When testing the WinBook notebooks, you removed 32MB of RAM "in order to have a level testing field." This would have been appropriate if the focus of the article had been the comparison of notebook processors, but with the focus on value, the notebooks should have been left in the configuration in which they were received. Obviously the testing procedure did not affect the outcome of the roundup, with the WinBook receiving the Editors' Choice award. The only field that should have been level was the price field, and keeping all the notebooks under \$2,000 did that.

ALAN MERLE HATCH  
via the Internet

Thank you for voicing your concerns. Although we reported the benchmark test scores with all the systems configured with 32MB of RAM, we also performed tests on the two WinBook units with 64MB for precisely the reason you mentioned: The focus of the story was getting the most for your money from a value notebook. We reported the scores with 64MB (see the footnote in the chart) and discussed them both in the benchmark test section and throughout the story so that readers would know what the systems can do as configured. We felt, however, that for readers to get a better sense of the impact of processor, graphics, and disk on system performance, we should keep at least one factor (memory) constant on the benchmark test chart.—Ed.

## IN THE CHIPS

I appreciated your discussion on the status of PC chips in the February 23 issue: specifically, "Glitzy Chips" (Trends) and Bill Howard's column "Where the Chips Fall." My concern is with the lack of supporting information on the motherboard requirements of these chips—in particular, which bus speeds and slot/socket form factors and configurations are necessary. Say I'm planning to buy a system. Will the bus or slot/socket support the next series of CPU chips? There was some mention of AMD going to a 200-MHz bus and a different socket with the K7. Is that true? How these questions are answered will determine not only my personal purchase strategy but my recommendations at work.

The one thing I hate is to be boxed in by motherboard and CPU design. What I want is to be able to buy the components, build the system I want over time, and upgrade the CPU once or twice. I'd like to see a standard

sidebar, once a month, with a graphic showing CPU and motherboard delivery forecasts for 12 to 18 months. Thanks for a great magazine!

JIM NORRIS  
via the Internet

In his column "Where the Chips Fall," Howard wrote, "Now the 300-MHz and 333-MHz versions (Mendocino) have 128K of Level 2 cache built into the CPU die, running at full CPU speed, which is almost as good as the 512K of off-CPU L2 cache the big-brother Pentium II CPU has built into the chip packaging." I shall always treasure this sentence.

As a tax professional, I often listen to my techie clients complain about how cryptic the tax code and regulations appear. Now I can use this sentence as a test to see whether they find *all* writing cryptic. I think I'll just put *PC Magazine* aside and indulge in some nice comfortable Roth IRA regulations.

PATRICK REA  
via the Internet

## WORK THAT PC

In the story "Make Your PC Work Better" (February 23), you describe a method to restart Windows without restarting the computer hardware (page 113). This seems un-

The one thing I hate is to be boxed in by motherboard and CPU design.

necessarily complex. You can accomplish the same thing by going to the Start menu and clicking on Shut Down, selecting Restart the Computer?, and then holding down the Shift key while selecting Yes.

JON J. SCHILD  
Salt Lake City, Utah

## NIGHT AT THE OPERA

I use Opera (Second Looks, February 23), so I thought I would mention that in addition to speed, it has flexibility. It's easy to customize, and you can do such tasks as open several windows and sort through them like index cards. Little things like the thin toolbars, easy zooming, and so on make Opera my first choice for a browser. Unfortunately, I have not been able to use it all the time, since some verification schemes work only with Navigator or Internet Explorer. Opera's not seamless by any means. On the other hand, it's not Microsoft or Netscape.

BRUCE FRASER DONNELLY  
via the Internet

## WEB NEWS

In "The Top 100 Web Sites" (February 9), all the news sites you mentioned are U.S.-based. For the highest-quality news coverage with a minimum of irrelevancy and a maximum of clarity, I strongly recommend the British Broadcasting Corp.'s site (<http://news.bbc.co.uk>). Not only does it provide excellent international news, but it also gives the clearest picture of what's going on in the U.S. As an American who has lived outside the U.S. most of his life, I can tell you that the BBC beats the pants off any American network.

MICHAEL KANO  
Vancouver, Canada

## THE EASIEST PORTAL

In your Second Looks column "What Makes a Great Portal" (February 9), you stated that one can create a portal site by building a simple local Web page. I did something even simpler than that: I made my Netscape bookmarks file my default page. Job done. Any time I bookmark a new site, my default page is automatically updated, because my bookmarks and default page are one and the same.

STEVE HART  
via the Internet

## THE WAY YOU LOOK AT IT

The graph shown with the item "The PC Proliferates" (Pipeline, January 19, page 9) is misleading. It shows the number of homes (in millions) without PCs. But since there are far fewer homes with annual household incomes of \$125,000 than homes with annual household incomes

of \$35,000, such a graph is useless for comparison. A better graph would show the *percentage* of homes without PCs by household income; this would let us know how disparate PC ownership is between \$30,000-income-level households and \$125,000-income-level households.

PAUL CHAPMAN  
Seattle, Washington

## SOFTWARE IN YOUR CEREAL, PART II

In response to the letters from Mike Aaron and Tim Herrick (Letters, January 19): Upgrading your PC does not require the repurchase of NetActive software. In situations where you have bought a new PC or upgraded your hardware, a call to Channelware Support will provide a transfer of your NetActive titles to the new setup.

The letters raised two other points. First, regarding the impact on the retail sector, we



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*Convenient grayscale copies.*  
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**Canon**

see NetActive software as expanding the market for consumer software. In comparable retail sectors, such as book selling, the advent of a new service like Amazon has not hurt traditional retailers; rather, it has supplemented the existing market and has encouraged many retailers to go online themselves.

Second, we agree that software piracy is a serious issue. Software publishers lose some \$12 billion to piracy each year. We believe that by lowering the cost of obtaining software legally and by continuing to introduce anti-piracy technology, we can reduce the incentive for piracy.

BARRY GANDER  
NORTEL CHANNELWARE  
*via the Internet*

## ADOBE STILL TOPS

John C. Dvorak's claim that Adobe's products are in shambles is ludicrous ("The Future of Adobe," February 23). Show me a professional graphics designer who doesn't use a single Adobe product and I'll show you a hack who charges by the hour, not by the job. Furthermore, Microsoft will never trounce Adobe because of the installed base of Adobe software at service bureaus and prepress houses around the world. Professional designers take their tools very seriously. I challenge Dvorak to show me one Microsoft product that even understands CMYK or EPS files.

RUSSELL DROULLARD  
Irvine, California

## HOME-STYLE EDITING

I agree with Jeffrey Harkavy (Letters, February 23), who expressed his distaste for the increased use of heavy card-stock pages in your print issues. I go one step farther than Harkavy, however: I remove all cardboard from every issue of *PC Magazine* prior to my first

## Corrections and Amplifications

In "The Top 100 Web Sites" (February 9), we misprinted the Web address for Google! The correct URL is [www.google.com](http://www.google.com).

In our review of the HP LaserJet 8100 in "Network Power Printing" (Networking First Looks, January 5, page 76), the average cost per printed page was cited as 9 cents. The actual cost per page is 0.9 cents.

In the Table of Contents of our February 23 and March 9 issues, we misprinted the number to call to order *PC Magazine Extra* on CD. The correct number is 303-665-8930 in the U.S. or 303-604-7445 elsewhere.

reading, perhaps putting some aside if the content looks appealing. Please take it as a compliment to your editorial staff that I find the "ripping ritual" to be more than compensated for by the indulgence that follows.

DAVID LOWENSTEIN  
*via the Internet*

## THE BEIGE BOX

Jim Seymour's column really struck a chord with me ("They Don't Have to Be Ugly," February 9). I built a PC last year to integrate with my home theater. The only available color choices for cases and peripherals: beige, light gray, and more beige. I now have a screaming Pentium system in my equipment rack that allows Internet access, DVD playback, writing, and game playing from my armchair via IR remote controls. The beige stands out like a cocker spaniel in a room full of black cats.

This seems like an opportunity for an enterprising company. I think users who build their own systems, as well as smaller PC assembly shops, would buy custom cases and peripherals in basic black and even outrageous colors like turquoise. The cases should have futuristic, classy styling and features like doors to cover less-used peripherals. How many people would love to own a PC that, when you waved your hand in front of the drive bays, would automatically open a door to allow CD-ROM access? I'd get one in a minute.

PHIL COMBS  
*via the Internet*

So Steve Jobs turned some heads by introducing cute little user-friendly PCs in bright colors to the home market. Why are people suddenly becoming so concerned with what a PC looks like rather than what it is capable of? True, to home users who are buying 450-MHz machines to surf the Net, function doesn't really matter. They want something that looks good in their living rooms. Well, I want a PC that does what I want it to when I want it to. As long as PCs are still coming in plain, non-designer colors that have been around for years, I'll know that what I'm paying for is the electronics inside, not the floral pattern or fruity color on the outside.

TONY CELLINI  
Reno, Nevada

## SERVICE WITH A SMILE

I find myself chuckling when I see or hear all the remarks about PC companies and their

service ratings. The fact is that almost all manufacturers outsource their service calls. The bias that some people have against particular brand names and the need for PC companies to have a good reputation become apparent when there is a significant difference in the service ratings for brands that are serviced by the same firm.

The guy who shows up to fix your printer today may say that he works for HP, but that doesn't mean he won't come tomorrow to fix your server or laptop and say he works for Compaq or Toshiba.

JASON KNOWLES  
*via the Internet*

## PICTURE THIS

In your recent review of Microsoft Picture It! 99 ("Point and Shoot Software," January 19), you should have mentioned that the software requires Microsoft Internet Explorer to run. If it is not on your computer, IE must be loaded before Picture It! can run. When IE loads, it really changes things, such as making Netscape very difficult to set as the default browser. This feature was reason enough for me to return the program. On the box, there is no indication that IE is a requirement. *PC Magazine* should make people aware of such issues in reviews.

PAUL A. BERT  
*via the Internet*

## F.Y.I.

I'd like to see a dedicated space each issue defining computing acronyms. Perhaps just a half page or so in the back by the index; nothing fancy. It's frustrating to read through an entire article and never know what an acronym stands for.

GLENN GURECKY  
*via the Internet*

Here it is, 1999, and I am afraid I'm alone in my quest to change a fundamental law of the universe. It may be too much for society to bear. Does anyone out there agree that WWW should be changed to something like Q? *World Wide Web* has three syllables; *WWW* has nine. We have an acronym that uses the only letter in the English alphabet to have more than one syllable, and we came up with a use for *three* of them! All those in favor of making a change, say "Q."

JOHN BURCH  
*via the Internet*

## How to Contact Us

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# Toshiba jumps into server market.

COMPUTERS: "The Magnia series is a perfect example of how we can provide the latest and most powerful technology that customers can benefit from and in the future," said Friedrichs, vice president marketing, TAIS, CSD. Magnia 7000 server offers a combination of performance, scalability to address the enterprise.

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# The Price Is Right

*PCs, Web access, and software: Will we get them all for nothing?*

**F**ree computers, free ISPs, and free applications. Sometimes it seems as if the future is going to be one long, free ride, but is this new "free market" the wave of the future?

Analysts who have been watching the steady decline in PC prices and Web access no longer speculate about the possibility of \$500 computers. Recently, start-up company Free-PC.com began offering free systems, with 15-inch monitors and Web access, in exchange for the right to display constant on-screen advertising. The advertising—which occupies 39 percent of the display—is downloaded to the system's hard disk at regular intervals and is displayed on-screen regardless of whether you're connected to the Internet.

The first 10,000 PCs—inexpensive versions of the Compaq Presario—went to the first 10,000 people who registered at the company's Web site and met certain demographic profiles. In the first two weeks the offer was in place, over one million applicants filed for a free system. Free-PC.com's business model is comparable to a newspaper's. A newspaper costs more to print than it does to buy—generating a loss for the publishing company from the sale of the paper. Profits from advertising pick up the slack.

But strings are attached. In addition to viewing the advertising, you must supply personal information to Free-PC.com, which customizes its advertising based on your profile. You must also agree to use your PC at least 10 hours a month. Free-PC.com will monitor the usage. The systems must be returned eventually.

Free-PC's model could have very positive implications. For example, low-income households are still far less likely to have PCs than higher-income ones, primarily because of the cost of buying a machine.

Bill Gross, CEO of Free-PC, isn't the only person to come up with the free-PC idea. Brian L. Halla, CEO of National Semi-

conductor, predicted not long ago that free PCs would become prevalent, and Intel executive Paul Otellini predicted the arrival of the free PC as well. Halla, speaking at

last year's Microprocessor Forum, said that it was "natural for the PC to follow the evolution of the cellular telephone," where-

by the hardware often comes free in exchange for service-based revenues. And the Safeway grocery chain is currently experimenting with plans to give shoppers free computers in exchange for online grocery orders.

Free Web access is another tempting idea. In the U.K., a host of companies, including British Telecom, the electronics retailer Dixons, and the supermarket giant Tesco, are giving away free Internet services. Customers who were slow to embrace the Internet are signing on in droves. Industry analysts aren't convinced that the model can be successfully duplicated in the U.S., however. Flat-rate local telephone charges are unheard of outside the U.S. U.K. customers pay for local calls by the minute, hence their reluctance to pay even more for monthly Internet charges.

Currently, the only company providing free Web access successfully in the U.S. is NetZero, which doles out free Internet services in exchange for customers putting up with ads that appear constantly on their screens.

Even if subscribers aren't put off by the constant barrage of advertising, will the free ISP model pay off in profits for providers? Kathryn Hale, Internet analyst for Dataquest, thinks this will remain the smallest niche in the U.S. market, because free ISPs with intrusive ads will appeal only to low-income users—who are not that appealing to advertisers. Drew Ianni, analyst at Jupiter Communications, is more optimistic. "Although the demographics may not be of a very high level, they will target a previously untouched mass-market segment that advertisers want to reach," he says.

Riding on the popularity of free e-mail, Web sites are also starting to offer free personal (and business) information-management services, where you can maintain and share meeting schedules and safely keep calendars and address books. The concept provides advertisers with a new way to target on-

line consumers and a new avenue for e-commerce transactions. Web portals are jumping on the idea as a way to attract members and keep them coming back. The major players include Jump!, Lycos's MyTime, ScheduleOnline, Visto Briefcase, When.com, and Yahoo! Calendar.—*Sebastian Rupley and Sharon Nash*



## Free at Last

The first applicants for Free-PC's computers will be required to meet certain demographic profiles. Those who qualify will get a new Compaq Presario with the following specifications:

- ▶ 333-MHz processor
- ▶ 15-inch high-resolution (1,024 by 768) monitor
- ▶ 32MB memory
- ▶ 4GB hard drive, (2GB for ads, 2GB for programs and data)
- ▶ 33.6-Kbps modem
- ▶ CD-ROM drive and 3.5-inch floppy disk drive
- ▶ Microsoft Windows 98
- ▶ Free Internet access with local dial-up and e-mail



## The Unwired Web

**T**he market potential for wireless Internet access has fueled a recent round of partnerships between telecommunications and computer companies. Market research firm Dataquest predicts that revenues for wireless data services will grow from \$460 million in 1999 to \$3 billion in 2003.

In an effort to make wireless networking reasonably priced and easy to use, Cisco Systems and Motorola recently announced an alliance to develop global, Internet-based wireless networks. The two companies plan to invest \$1 billion over the next four or five years to implement the project.

To build wireless capabilities into the Palm platform, 3Com recently acquired Smartcode Technologie, a French developer of wireless data communications and Internet-access software. 3Com expects to deliver wireless Web access in its upcoming 3Com Palm VII.

Meanwhile, Nextel Communications has joined with Motorola, Netscape, and Unwired Planet to form the Nextel Online family of wireless Internet services. Scheduled for launch in six cities later this year, a wireless Internet portal called Nextel Online will include stock quotes, weather, business headlines, and Nextel's Internet-based services.

Microsoft is also jockeying for position in the wireless business, through a new venture with British Telecom to develop a range of Internet, intranet, and corporate data services for worldwide mobile customers. And a joint venture between General Magic and Wireless Knowledge (a new company partly owned by Microsoft and Qualcomm) will bring secure wireless access to Microsoft Exchange and mobile devices accessing the Internet.

Meanwhile, Sierra Wireless and its partners AT&T Wireless Services, Bell Atlantic Mobile, GoAmerica, Hewlett-Packard, Pinacor, River Run Software Group, and Sharp Electronics recently announced new hardware, software, and service bundles that include the Sierra AirCard 300—a wireless modem designed for Windows CE devices such as the HP Jornada and the Sharp Mobilon Pro. Customers will be able to buy a complete package—hardware, software, and services—from one vendor.—*Sharon Nash*

## Digital Camcorders Do the Net



During PC Magazine Labs' evaluation of products for this issue's story "Digital Video Cameras: Ready to Roll," we encountered a wide range of quality among the video clips the cameras produced. So we set out to determine whether video quality really matters after the clips are encoded into a compressed format appropriate for transmission over modems. Our recommendation: If you're shopping for a digital camcorder to deliver video over the Web, you don't need to pay extra for a model that offers high-quality video unless your audience's network-access speed is greater than 56 Kbps.

### Web Screen Test

As these still shots taken from two digital video cameras and compressed at different bit rates illustrate, the higher-quality, more-expensive camera produces visibly superior images only at 200 Kbps.

A recent example of Web-based video supports our test results. In February, Victoria's Secret made a bold attempt to promote its business on the Internet by broadcasting a fashion show via RealVideo. The company succeeded in generating publicity, but many questioned the effectiveness of exhibiting the latest collection over the Web. Although Victoria's Secret encoded the video at three bit rates—28.8 Kbps, 56 Kbps, and 100 Kbps—most viewers connected at the lowest bandwidth, which resulted in video with blocky distortions.

We suspected that the quality differences among video cameras aren't noticeable when video is delivered at a low bit rate. To test the relevance of the video camera's performance when delivering

video over a low-throughput medium like the Web, we encoded the test clips from the expensive and the inexpensive video cameras into three bit rates—28.8 Kbps and 56 Kbps, appropriate for viewing over a modem, and 200 Kbps, suitable for a corporate intranet.

As we expected, the differences in camera quality were lost in all the blur and speckles when the video was encoded at the 28.8-Kbps RealVideo format. At 56 Kbps, the differences began to emerge, not so much in the video's sharpness as in its color and clean presentation. When we raised the bit rate to 200 Kbps, the lower-quality video camera could no longer hide



behind the blurry and blocky distortions inherent in a low-bandwidth format. Only at this high-quality format did we begin to resolve the thin patterns on our subject's shirt.

For entertaining today's Web audience with 28.8-Kbps and 56-Kbps access speed, an average digital video camera should do the job. But in order to impress corporate intranet users and tomorrow's Web customers with cable modem or DSL connectivity, a better camera may be worth the price.—*S. Jae Yang and Mark Valentine*



## INTERNET

## Quantum Security

**O**ver the next few years, public-key cryptography is likely to become firmly established as the security standard for the Internet, assuring the privacy of communications and authenticating user identities for e-commerce. Drawbacks exist, however. For example, it requires a high degree of security for private keys. Like passwords, private keys that are changed regularly are less likely to be compromised. But some network nodes are physically inaccessible—think of communications satellites. Sending keys over these networks would be self-defeating.

Another difficulty arises in connection with information that must be kept secure for many decades, such as U.S. census data. Public-key cryptography is based on the inability of present-day computers to factor large numbers using known techniques. This inability

cannot be expected to continue, however, especially since the discovery in 1994 by Peter Shor, a scientist at AT&T Labs, of an algorithm that can factor large numbers on a hypothetical future machine called a quantum computer. Furthermore, a mathematical breakthrough for factoring large numbers on existing computers cannot be ruled out.

So it's reassuring to discover that a solution is in sight: quantum cryptography, using quantum-key distribution. Based on the same physical principles as quantum computing—which uses the vast capabilities of atomic systems to

represent information—quantum-key cryptography lets you transmit keys securely and easily detect attempts to intercept them. Last October, scientists at Los Alamos National Laboratory announced that they had transmitted quantum keys over a distance of 1 kilometer in “free space” rather than inside a fiber-optic cable. This is a significant milestone in earth-to-satellite communication. Even though the latter distance is far greater, the difficulty lies in getting through the lower atmosphere.

Public-key cryptography is thought to be secure only with today's computers and mathematical methods, but quantum-key distribution is secure given our understanding of quantum theory. A system is only as secure as its weakest link, however. Indeed many students of quantum technology insist that it's impossible to create a real-world system that's as secure in fact as in theory.—Marc M. Groz



## Amazon Muddies Its Waters

**W**hen approaching the edge of a cliff, tread carefully. At night, don't approach at all. The figurative cliff that journalists approach only with trepidation—day or night—is the line that separates editorial content from advertising. In print journalism, there are very clear standards and practices for handling the two that let readers know what's editorial and what's advertising. We wrangle over the details of these practices of course, but the traditional standards shed enough light on the subject in most cases to make it clear where the cliff begins.

On the Internet, however, we're all still stumbling in the dark. We may not yet have hard and fast “rules” for identifying editorial content and advertising, but the requirement to keep them clearly separate is just as great. One leading online business found this out the hard way.

Pioneering online bookseller Amazon.com recently acknowledged that some of the books receiving its well-respected buying recommendations made the lists by virtue of large payments from publishers. In its defense Amazon, which has built its success on the relationship between its editors and its customers, protested that the editors were free to reject the payments and not recommend a book if they thought it unworthy.

Understandably, these protestations didn't carry much water with Amazon's customers, who complained to the company about the practice. Amazon quickly did the right thing, announcing it would start noting which book placements were paid for. CEO Jeff Bezos hit the right notes when he said that he recog-

nized the need to maintain high editorial standards.

Unfortunately, Bezos went on to add that Amazon is now holding itself to “a higher standard than physical stores.” Going further, he suggested that other sites don't live up to that standard either. The public outcry over the now-ended practices should have made it clear to Bezos that people think this a very basic standard, not a high standard at all. They want to be able to distinguish between editorial content and advertising.

If Bezos misses this point, he's not alone. Just about every editorial-driven Web site that accepts advertising is struggling to develop standards for separating the two types of material. Many Web sites, including our own ZDNet, occasionally will carry banner ads that look a lot like artwork accompanying the editorial content below. Closer to home, our own site, [www.pcmag.com](http://www.pcmag.com), includes something referred to as “sponsored links.” We believe that listing them at the bottom of the page in a separate box makes it clear that this is a form of paid advertising, but I wonder if every visitor understands that.

Why are these distinctions important? The only satisfying—and profitable—relationship an editor can have with readers or site visitors is one of trust. In this business, if readers and viewers can't trust the honesty of your editorial content they won't be as likely to respond to the advertising you carry. Advertisers then shy away and find other methods of reaching potential buyers.

Editors who cross the line risk losing readers and advertisers. It's like stepping off a cliff. Go over that line and you probably won't survive. I suspect Amazon has hurt itself more than it knows. Let's hope the rest of us aren't so in the dark that we make the same misstep.



Jake Kirchner



NEC



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## PAGERS

## Two-Way Pagers That Beep and Browse

The humble pager is evolving rapidly into an e-mail and information appliance that lets you send requests to Web sites and receive information back in seconds. This spring, two expanded service offerings extend the pager's reach by letting you receive stock quotes, restaurant locations, phone numbers, and news reports, as well as send and receive e-mail in most locations nationwide.

GoAmerica Communications' Go.Web service, available in mid-April, works on the RIM Inter@ctive 950 pager from Research in Motion and lists for \$259 bundled with a one-year service plan or \$359 with a six-month service plan. The Motorola PageWriter 2000X, at around \$360, should be available during the second quarter of the year. It will have a lighted keyboard for easier data entry in dim light and more memory (3.25MB, up from 1.25MB) for application and data storage than the current PageWriter 2000.

We tested prerelease versions of both pagers and the accompanying information services. The Motorola PageWriter 2000X is the more powerful of the two pagers, with its wider range of services including traditional paging and voice-mail alerts, rechargeable batteries, an open platform for third-party apps, and a larger display. The RIM Inter@ctive 950 is smaller, lighter, and simpler, and the unit is appealing more for its two-way e-mail and data querying than for traditional paging.

**Information Services:** Both pagers are available with nationwide coverage for two-way messaging, e-mail, and data retrieval. The Go.Web service uses Bell South's data network and offers categories for business, finance, entertainment, news, sports, travel, and weather. News sources include AccuWeather, CNET News, Fox Sports, The Motley Fool, Travelocity, and Variety.com. Depending on your request and the individual service, responses are delivered to the device within seconds.

The basic plan costs \$9.95 per month for 50K

of e-mail and data, plus \$.30 for each additional 1K. According to GoAmerica, typical messages and data inquiries use about 500 bytes each, so the basic plan would allow for 100 pieces of information. For unlimited e-mail only, the flat

rate is \$39.95 per month. Unlimited e-mail and Web content plus live operator messaging costs \$59.95 per month with \$.40 per assisted message. Messaging only via operator costs \$9.95 a month plus the \$.40 per message charge. GoAmerica's plan doesn't offer unassisted alphanumeric paging—people can contact you either via e-mail or by operator.

The Motorola PageWriter 2000X is serviced by Skytel and PageNet. Skytel's basic plan for paging and e-mail costs \$24.95 per month. Voice mail notification, faxing, and 800-number service are additional costs. The PageWriter 2000X's 3MB flash memory lets you download several optional service applications via a PC serial connection to the pager's docking station. Services include Wolfe

Tech's PocketGenie with Web-based information including news, weather, driving directions, movie and restaurant information, and sports scores. Unlimited access costs \$29.95 a month. PocketGenie works by sending messages to the pager in response to your queries. StockSentry's StockBoss lets you track investments and get unlimited real-time stock quotes for \$19.95 per month. Motorola's Productivity Software Suite includes task, scheduling, alarm, and notepad functions for \$19.95 a month. Motorola's Entertainment

Pack (\$9.95 a month) includes three games you can play against live opponents or with other pager users. A Lotus Notes client and a photo album app are also available.

**Sizes, weights, and batteries:** Both pagers are larger and heavier than standard alphanumeric pagers and are designed to be worn on your waist in a plastic, clip-on holster. The 0.9- by 3.5- by 2.5-inch (HWD) RIM 950 weighs 4.8-ounces with a single double-A battery and 5.8-ounces including a holster. The PageWriter 2000X is a bit larger, measuring 1.0 by 3.6 by 2.5 inches with its flip-up screen closed, and it weighs 6.8 ounces including a rechargeable nickel hydride battery or 7.6 ounces including a holster. The PageWriter 2000X's battery pack charges in the docking station in one hour for a charge that lasts about one week. The slightly more compact RIM 950 uses a single disposable double-A alkaline battery rated to last two weeks.

**Pointing devices and keyboards:** The RIM 950 has 31 keys, a push/dial button for selecting and activating menu options, and a simple interface with pull-down menus. The PageWriter 2000X has 47 keys, with new backlights for the keys, making data entry in dim lighting easier than with the earlier model. It also has a joystick button for navigation, as well as Enter, Home, and Tab keys.

**Display quality:** The RIM 950's screen, which measures 0.8 by 2.5 inches, can be set to display

### RIM INTER@CTIVE 950

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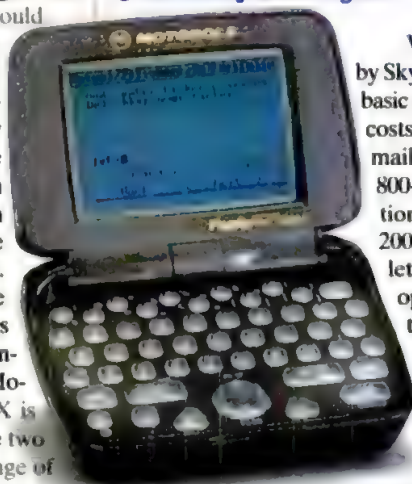
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- 31-key keyboard
- Six- to eight-line, 26-character, backlit display
- Sold via GoAmerica

six to eight lines of text with 26 characters per line. Its monochrome LCD screen is reasonably visible in daylight or room light, even without the backlighting turned on. The PageWriter 2000X's screen is larger, however, measuring 1.7 by 2.4 inches and displaying nine lines of text with 27 characters per line. The unit has one top and two bottom status and menu lines. The Motorola PageWriter 2000X's display lets you view more content than the RIM 950's, and the PageWriter 2000X's applications make greater use of graphics than those on Go.Web, which are text only.—Bruce Brown

### MOTOROLA PAGEWRITER 2000X

[www.pagenet.com](http://www.pagenet.com)

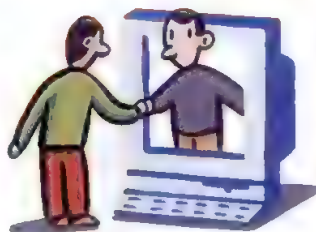
- Two-way paging, e-mail, and information services
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- Nine-line, 27-character, backlit display
- Sold via Skytel and PageNet





## Free Business Services

By Tom Giebel



**S**mall businesses with small budgets have more options than ever for establishing their Web presence. Zero budget? Don't worry. Nowadays, many sites offer free Web space and services in exchange for running banner ads on your pages. These freebies aren't just limited to Web space. You can put up a site, start a mailing list or discussion group, embark on an advertising campaign, and more, all without opening your wallet. Setting up an online store might set you back a few dollars, but you'll be surprised at how much you can get for nothing these days. For recommendations on the best sites for setting up free personal home pages and community sites, see this issue's feature story "A Web Site of Your Own." Here we cover the business sites.

### Get a Free Business Site

➤ Once you've decided to use a free hosting service, choose carefully. You don't want to host your business Web site in the same neighborhood as some teenager's fan site for a heavy metal band—or something even worse. Luckily, many free hosts are now catering specifically to small businesses and prohibiting personal sites. By joining one of these, you automatically become listed in its business directory. **HyperMart** ([www.hypermart.net](http://www.hypermart.net)) offers many features normally offered only by pay services, such as CGI, SSL, RealVideo, and support for Microsoft FrontPage extensions. **Click2site** ([www.click2site.com](http://www.click2site.com)) gives you an ample 30MB of space, real-time traffic reporting, and FrontPage support. For those who don't want to deal with HTML, CNET's **B-City** ([www.bcity.com](http://www.bcity.com)) offers a wizardlike "5-minute Web site" tool.

### Build a Customer Community

➤ Adding interactivity to your site is a great way to keep your customers involved and coming back for more. E-mail newsletters are a tried-and-true method for building customer relationships. **ONElist** ([www.onelist.com](http://www.onelist.com)) offers a free, ad-sponsored mailing-list service with a powerful set of subscription management tools. The free forum service from **VantageNet** ([www.vantagenet.com](http://www.vantagenet.com)) lets you add discussions to your site. Each forum has a customizable design and offers multiple ways to view and sort messages. Although not as customizable as VantageNet, **Netbabbler** ([www.netbabbler.com](http://www.netbabbler.com)) also offers threaded discussion areas that are easy to set up. In case you prefer a simple, bulletin-board-style

feedback forum to threaded messaging, **Guestbook4Free** ([www.guestbook4free.com](http://www.guestbook4free.com)) lets you customize both the look of your guest book and the fields your visitors fill in. Another way to gather feedback is through online polls and surveys. **VantageNet** and **Survey Engine** (<http://mail.infotrieve.com>) both offer free online questionnaires.

### Promote Your Site

➤ One way to increase traffic is by buying banner ads on other sites. If you participate in one of the popular banner-exchange programs, however, these ads can even be free.



By choosing a free host that specializes in business Web sites, you will be listed in a directory with appropriate categories. At B-City you can set up your site within minutes and immediately get down to business.

Two of the more popular banner-exchange services, **LinkExchange** ([www.linkexchange.com](http://www.linkexchange.com)) and **SmartClicks** ([www.smartclicks.com](http://www.smartclicks.com)), offer very similar features. For every two banners you serve on your site, one of your banner ads appears on another partic-

ipant's site. You have some control over what kinds of sites you exchange banners with, and there are a variety of tracking tools that can help you see how your banners perform. For other banner-exchange programs, investigate the **Web Publishers' Advertising Guide** at [www.wpag.com/bannerad](http://www.wpag.com/bannerad).

### Set up an Online Store

➤ With any of the free services mentioned above, your methods for selling merchandise or services are limited to mail, phone, and fax. For real shopping-cart and transaction-processing capabilities, you'll have to spend some cash. But you don't need to spend a lot. Two inexpensive storefront services available from Yahoo! and GeoCities will let you set up an online shopping site quickly and easily. Both services offer flexible design options, secure transactions, and the benefit of being part of a larger shopping community. You can set up a **Yahoo! Store** (<http://store.yahoo.com>) in minutes and immediately become part of the Yahoo! Shopping site and search engine. The monthly price for a Yahoo! Store is \$100 if you sell 50 items or less and \$300 for up to 1,000 items, both with no setup fee. **GeoShops** ([www.geocities.com/join/geoshops](http://www.geocities.com/join/geoshops)) lets you build a storefront or catalog easily, using a variety of prebuilt templates. GeoShops' basic membership costs \$24.95

per month but lacks secure ordering functionality. The Web service's transaction-processing program offers secure transactions and more for \$99.95 per month plus \$0.55 per transaction, with a one-time setup fee of \$195. **PC**





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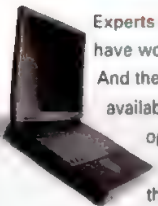
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TREK<sup>2</sup> 300



TREK<sup>2</sup> 300



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|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Processor            | Intel® Celeron™ processor 300MHz                                                                                                                                                                                                                                                                                                 | Intel Pentium II processor 300PE MHz                                                                                                                                                                                                                                                                                             | Intel Pentium II processor 333MHz                                                                                                                                                                                                                                                                                                | Intel Pentium II processor 366MHz                                                                                                                                                                                                                                                                                                |
| Cache                | 128KB L2 pipeline burst cache                                                                                                                                                                                                                                                                                                    | 256KB L2 pipeline burst cache                                                                                                                                                                                                                                                                                                    | 256KB L2 pipeline burst cache                                                                                                                                                                                                                                                                                                    | 256KB L2 pipeline burst cache                                                                                                                                                                                                                                                                                                    |
| RAM                  | 32MB EDO DRAM                                                                                                                                                                                                                                                                                                                    | 64MB SDRAM                                                                                                                                                                                                                                                                                                                       | 64MB SDRAM                                                                                                                                                                                                                                                                                                                       | 128MB SDRAM                                                                                                                                                                                                                                                                                                                      |
| Hard Drive           | 4GB hard drive (removable)*                                                                                                                                                                                                                                                                                                      | 6GB hard drive (removable)*                                                                                                                                                                                                                                                                                                      | 6GB hard drive (removable)*                                                                                                                                                                                                                                                                                                      | 10GB hard drive (removable)*                                                                                                                                                                                                                                                                                                     |
| Monitor              | 12.1" SVGA TFT display                                                                                                                                                                                                                                                                                                           | 13.3" XGA TFT display                                                                                                                                                                                                                                                                                                            | 14.1" XGA TFT display                                                                                                                                                                                                                                                                                                            | 14.1" XGA TFT display                                                                                                                                                                                                                                                                                                            |
| Extra Storage        | 3.5" floppy disk drive (dedicated bay)                                                                                                                                                                                                                                                                                           | 3.5" floppy disk drive (dedicated bay)                                                                                                                                                                                                                                                                                           | 3.5" floppy disk drive (dedicated bay)                                                                                                                                                                                                                                                                                           | 3.5" floppy disk drive (dedicated bay)                                                                                                                                                                                                                                                                                           |
| CD-ROM               | 24X CD-ROM drive* (dedicated bay)                                                                                                                                                                                                                                                                                                | 24X CD-ROM drive* (dedicated bay)                                                                                                                                                                                                                                                                                                | 24X CD-ROM drive* (dedicated bay)                                                                                                                                                                                                                                                                                                | 24X CD-ROM drive* (dedicated bay)                                                                                                                                                                                                                                                                                                |
| Graphics             | 4MB AGP graphics accelerator                                                                                                                                                                                                                                                                                                     | 4MB AGP graphics accelerator                                                                                                                                                                                                                                                                                                     | 4MB AGP graphics accelerator                                                                                                                                                                                                                                                                                                     | 4MB AGP graphics accelerator                                                                                                                                                                                                                                                                                                     |
| Sound System         | Built-in stereo speakers & microphone                                                                                                                                                                                                                                                                                            | Built-in stereo speakers & microphone                                                                                                                                                                                                                                                                                            | Built-in stereo speakers & microphone                                                                                                                                                                                                                                                                                            | Built-in stereo speakers & microphone                                                                                                                                                                                                                                                                                            |
| Warranty             | 5-year/1-year Micron limited warranty                                                                                                                                                                                                                                                                                            | 5-year/1-year Micron limited warranty                                                                                                                                                                                                                                                                                            | 5-year/1-year Micron limited warranty                                                                                                                                                                                                                                                                                            | 5-year/1-year Micron limited warranty                                                                                                                                                                                                                                                                                            |
| Software Included    | Microsoft® Windows® 98<br>System Wizard Mobile Client™<br>Norton AntiVirus                                                                                                                                                                                                                                                       | Microsoft Windows 98<br>Microsoft Office Small Business Edition<br>Free* Upgrade to Microsoft Office 2000<br>System Wizard Mobile Client™<br>Norton AntiVirus                                                                                                                                                                    | Microsoft Windows 98<br>Microsoft Office Small Business Edition<br>Free* Upgrade to Microsoft Office 2000<br>System Wizard Mobile Client™<br>Norton AntiVirus                                                                                                                                                                    | Microsoft Windows 98<br>System Wizard Mobile Client™<br>Norton AntiVirus                                                                                                                                                                                                                                                         |
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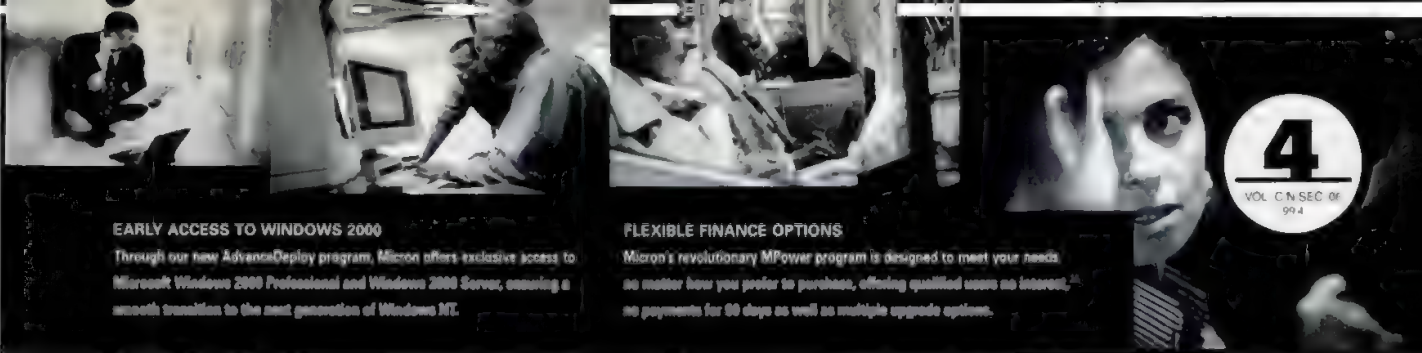
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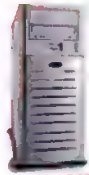
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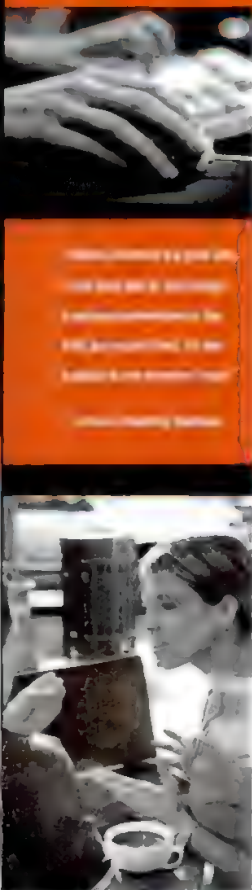
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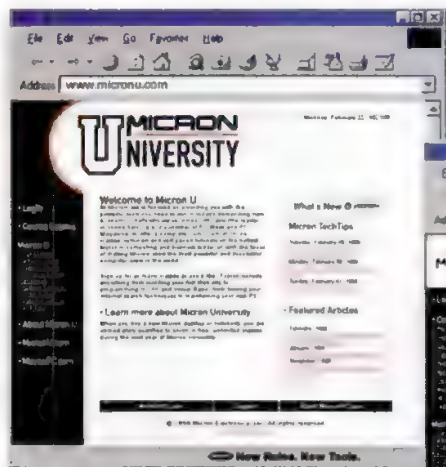
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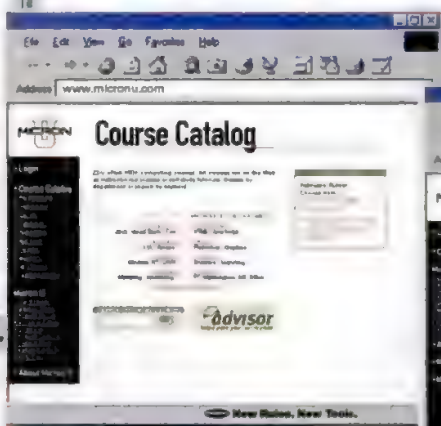
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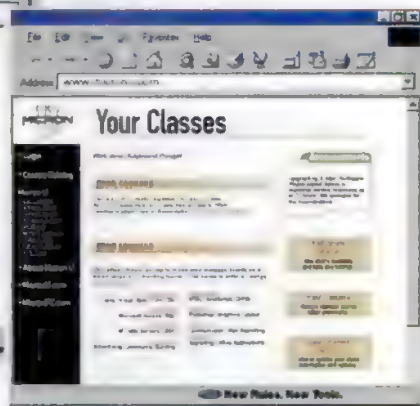
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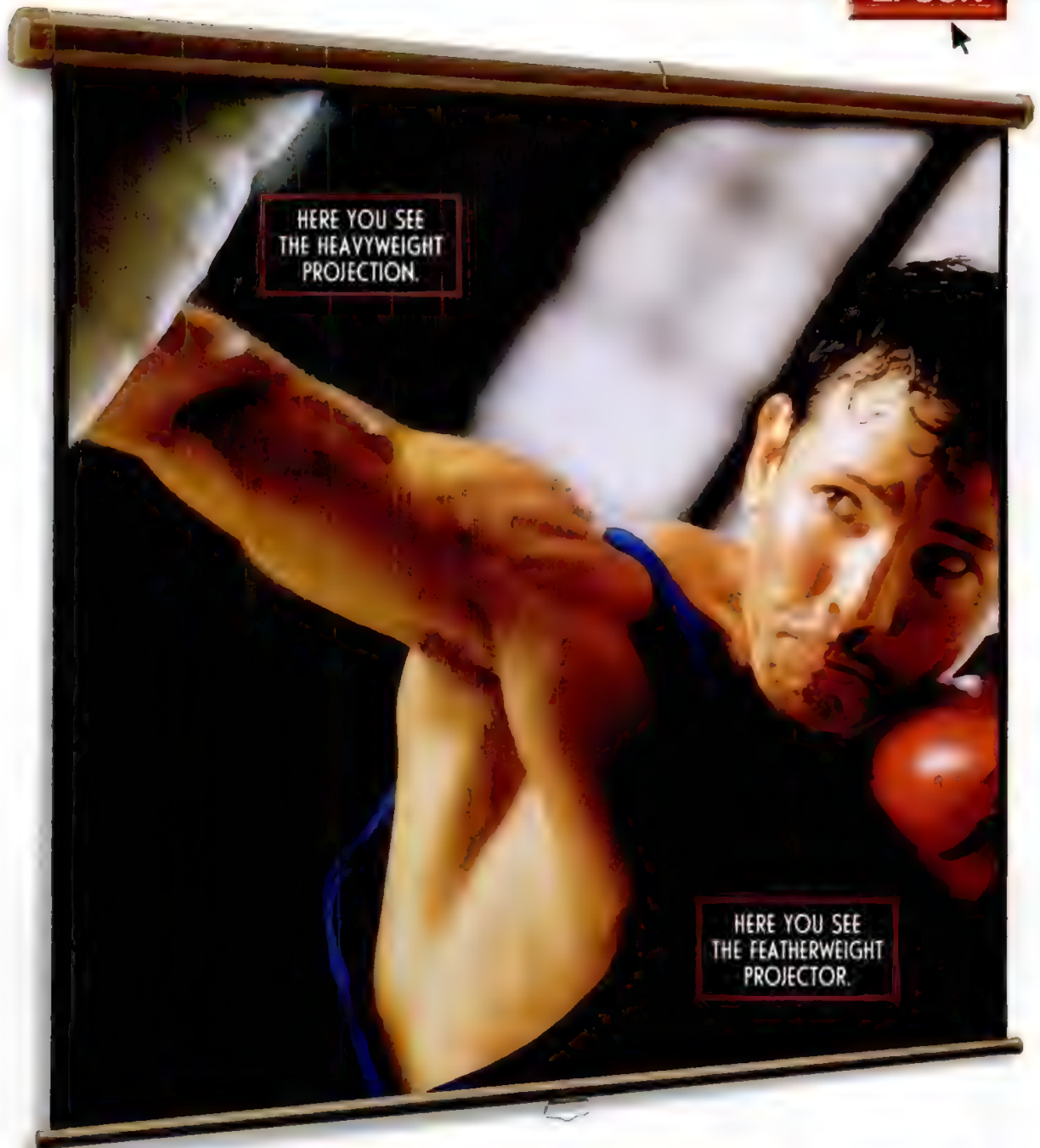
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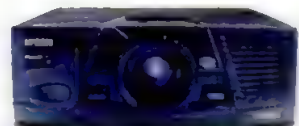
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## Palm Evolution

*New 3Com Palm devices include the power user's Palm IIIx with more memory and the sleek, "executive special" Palm V.*

By Bruce Brown

If you're like a lot of people out there, you've come to love Palm Computing's family of connected organizers. Devices that can easily claim to be the only widely successful hand-helds in history, the Palms have continued to draw crowds and sales because they do what they promise to do, they do it well, and best of all, they do it easily.

Building on the strengths of the platform are two new devices that were announced in February: the Palm IIIx

odized aluminum chassis, this sleek, sub-half-inch-thick device certainly makes a bold statement. The V's performance is virtually identical to that of the IIIx, but considering the price tag, the device will ultimately appeal more to those who prefer style over substance.

### BETTER DISPLAYS, NEW OS

Both new Palm devices have much better, more readable displays than their predecessors. The liquid-crystal monochrome screens on both models are now less reflective for better daylight

When you hold down the power button to turn on the backlight, characters and graphics on the new models are brighter against a darker background.

The new models also both run Version 3.1 of the Palm Operating System. The application software that they use is the same as that of the Palm III; however, the new units are based on a new processor—the 16-MHz Motorola DragonBall EZ. This means that current Palm users won't be able to upgrade their devices to the new OS, because the Palm



(\$370 street) and the Palm V (\$450 street). But Palm users need not worry: Palm Computing has not abandoned the line's vaunted simplicity and its broad access to hundreds of third-party applications.

The 3Com Palm IIIx retains the same case design as its predecessor, the Palm III (which is now priced at \$300 street), but has more standard RAM, as well as an upgrade slot to enable you to pump that memory up even further. The 3Com Palm V represents a completely new design: Housed in a come-hither, an-

**PALMS FOR ALL:**  
The 3Com Palm V (left) is less than half an inch thick; the IIIx (right) has twice the RAM of the III.

and room-light viewing. Both also tout a new reverse backlight that considerably improves visibility in low-light settings.

OS 3.1 is written solely for the new Motorola CPU.

According to Palm Computing, the benefits of the new OS are evidenced by 20 percent better battery performance and 15 percent better processing speed. We would give equal weight to the additional memory in the IIIx, however, and note that battery performance remains the same.

### CHOOSE YOUR DESKTOP ORGANIZER

A new feature that the Palm OS 3.1 brings to the platform is an automatically configuring conduit for Microsoft Outlook.

### BANK ON IT:

Do your banking transactions on the Web in real time with First Internet Bank of Indiana—and pay lower fees, too. *Page 48.*



### HOME NETWORKING:



The Compaq Home Phoneline Networking package presents the easiest solution

thus far for sharing files, peripherals, and Internet access. *Page 56.*

### SLIM SERVERS:

We test three new micro-servers that may change the way you network your small business. *Page 76.*



### More Products Reviewed

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# FIRST LOOKS

When you install Palm Desktop 3.1 on a host PC, the software automatically scans your system for Outlook. If Outlook is installed, you're given the option of setting up your new Palm device to synchronize with Outlook—rather than with the Palm Desktop Organizer. When we tested on a PC with Outlook 98 installed, the software detected the program, offered a choice of conduits, and successfully synchronized data on the first attempt.

## PALM VERSUS CE

Microsoft Windows CE-based palm-size PCs (P/PCs) from vendors such as Casio, Everex, Philips, and Uniden have been on the market for almost a year. And recently, Compaq and Hewlett-Packard announced color-screen versions of their Windows CE P/PCs. So why not a color-screen Palm? Palm Computing did consider adding a color display but felt that the added cost and increased power consumption—as well as a lack of user demand—were good enough reasons not to introduce such a model at this time.

Many users admire the Windows CE P/PCs' greater standard functionality compared with Palm devices, due chiefly to Windows CE's built-in applications, larger memory capacity, and familiar Windows-like interface. But the Palm family devices boot faster, open applications and find data quicker, and have much longer battery lives than their Windows CE counterparts.

## PALM VII ONLINE

Later this year, Palm Computing will introduce the Palm VII, a sub-\$800 device that will combine Palm III capability with a wireless Internet "clipping" push-pull technology and minimum monthly service charges.



The idea is that with your Palm VII, you can send a message to a service (an online movie guide or FedEx, for example), make a query, and get information back in a format that will fit on the Palm VII's screen.

You will also be able to set specific services to push information to you automatically. Palm VII testing is expected to last until the summer. No date for commercial release has been set, so if you crave more from the Palm platform, you'll just have to make do with a IIIx or V in the interim.

The Palm hand-held devices have certainly evolved. But with the new models, the two factors that have largely contributed to the company's field-leading success continue: ease of use for basic PIM applications and compatibility with many third-party utilities and vertical applications. Palm Computing has wisely stuck with a winning formula.

## 3Com Palm IIIx

The 3Com Palm IIIx is the same size as the Palm III (4.7 by 3.2 by 0.7 inches, HWD), so accessories that clip onto the bottom of the III will also fit the IIIx. At 5.6 ounces with battery and stylus, the IIIx weighs about two-tenths of an ounce less than its predecessor. And, like earlier models, it runs on two triple-A batteries.

But the biggest news with this

device is the IIIx's memory subsystem. The IIIx doubles the amount of internal RAM found on the III to 4MB. Also, the IIIx has an unused upgrade slot, which can accept either more memory or third-party add-ons

such as pager cards. With the IIIx, memory is placed on the system board rather than strictly on a replaceable module, which was the case with the 3Com Palm III. According to Palm Computing, this new design is more durable.

Users who run many applications or want to carry large amounts of data will appreciate the extra memory. This doubled storage capacity means that the IIIx can hold 12,000 addresses, ten years of appointments, 3,000-to-do items, 3,000 memos, and 400 e-mail messages. Power Palm users who feel cramped by their IIIs would do well to check out the IIIx. And for new users, the extra \$70 for the IIIx will be money well spent.

## Secure Your Palm III Memos

Encrypting business and personal memos is a smart idea, especially for high-volume, mobile Palm III users who are susceptible to PDA loss or theft. JAWS L5 Data Encryption—PDA Edition (\$20 street), from JAWS Technologies, is an industrial-strength data-encryption application for Memo Pad files on Palm Computing devices running Palm OS 3.0 (as we completed this review, the company was still testing with Palm OS 3.1). Although it's easy to install and use, this utility provides no key recovery—so if you forget your encryption passwords, your memos will be irretrievable.

JAWS L5 installs smoothly on the Palm III via the Palm Install tool; the standard Memo Pad is replaced with L5 Memo. Once you open the program with a one-time ID code, existing memos are moved automatically to L5 Memo by category (such as business, personal, and unfilled) but are not encrypted until you give the command. Encryption takes place almost immediately.

You can encrypt files individually, by category, or both ways. The New Memo screen has an encryption prompt for entry of a unique password or phrase of up to 512 characters that's used to both encrypt and decrypt a memo. The List View menu provides prompts to encrypt and decrypt all memos in a category. Memos with their own encryption passwords cannot be decrypted when their category is decrypted—an extra level of security.

An icon on the List View screen identifies encrypted memos. To identify files, you can select the character number in the memo where encryption begins, letting you see a memo title or header, while the rest remains encrypted. Encrypted files



## 3Com Palm V

The biggest news about the 3Com Palm V is its size, followed closely by style. At less than half an inch thick, the V is about half the thickness of the III and has a high-tech anodized aluminum shell. The V measures 4.5 inches high by 3.1 inches wide and weighs less than 4.4 ounces, battery and stylus included.

This slick new design does limit expandability, however. The unit's memory is fixed at 2MB, and there's no upgrade slot available. Also, the change in case design means that bottom-clipping accessories for the III and IIIx will not fit the V.

Unlike its alkaline-powered relatives, the V runs on nonremovable lithium ion batteries. The V's docking cradle has a jack on its serial port connector

**STYLIN':**  
Protect your 3Com Palm V's display with a variety of cases.

to accept a power lead from the AC adapter/battery charger. After an initial 3-hour charge, the V is rated to stay charged indefinitely if placed in the docking cradle for just a few minutes per day.

The 3Com Palm V also has a new contrast button on the top of the case with on-screen contrast controls, replacing the exterior contrast dial on the larger Palm models. The power button, which also turns on the new reverse backlighting, is now located on the top front edge of the case.

There are two pen slots on



the V (one on either side), but only one stylus is included in the package. That's because the other slot can be used to attach any one of a myriad of optional covers and cases. Standard fare is a flexible, embossed-leather cover that, when attached, looks and acts like a book cover. Fancier cases from third-party vendors such as Coach and Dooney & Bourke are also available.

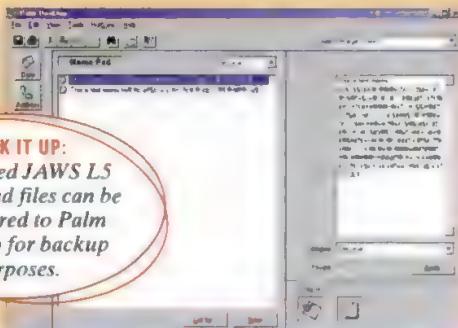
If you don't want to use a cover, you can use both pen slots to carry styli, which is particularly helpful if you have a tendency to lose them. And the dual pen slot design gives you the ability to switch which side the display cover opens from—a feature that undoubtedly will appeal to left-handed users.

There are new accessories from Palm Computing for the Palm V, starting with a 33-Kbps

3Com Palm V Modem (\$170 street). This modem snaps onto the back of the Palm V, runs on two triple-A batteries, and is rated for 150 HotSync operations or 5 hours of continuous connection time. There's also the Palm V Travel Kit (\$50 street), which includes a HotSync travel cable and AC/DC converter charger with adapters for international connections.

The 3Com Palm V's smaller size and lighter weight improve its portability, but it will likely appeal mostly to Palm users who are attracted to the sleeker look. **3Com Palm IIIx.** Street price: \$370. **3Com Palm V.** Street price: \$450. PC requirements: 8MB RAM; 20MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. Palm Computing Inc., a 3Com Company; Mountain View, CA; 800-881-7256; [www.palm.com](http://www.palm.com). **PC**

**BACK IT UP:**  
Encrypted JAWS L5 Memo Pad files can be transferred to Palm Desktop for backup purposes.

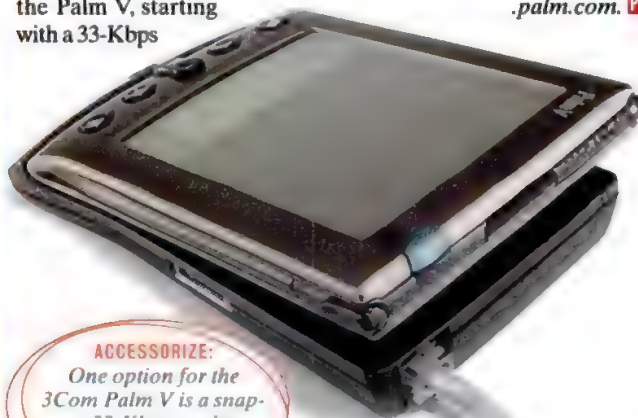


cannot be beamed via IR to other Palm III users, although they are transferable to the Palm Desktop application for storage. For security, it's best to HotSync after file encryption to replace unencrypted desktop files. JAWS L5 is not compatible with other PIMs for file backups.

To save memory and maximize security, JAWS L5 overwrites unencrypted files with encrypted files. The application uses a long—but fast—4,096-bit encryption algorithm and has other built-in features to deter hackers, such as random encryption patterns and encrypted text that varies in length from the original text.

JAWS L5 Data Encryption secures data like a steel trap. Be careful not to use too many passwords that you can't recall, though, or you'll be out of luck. —*Marge Brown*  
**JAWS L5 Data Encryption—PDA Edition.** Street price: \$20. Requires: 390K hard disk space; 35K RAM; Microsoft Windows 95, 98, or NT 4.0; 3Com Palm Connected Organizer with Palm OS 3.0 or higher; JAWS Technologies Inc., Calgary, Alberta, Canada; 888-301-5297, 403-508-5055; [www.jawstech.com](http://www.jawstech.com).

**ACCESSORIZE:**  
One option for the 3Com Palm V is a snap-on 33-Kbps modem that's self-powered.





## Hard Disk Undo

*FlashBack and GoBack complement your backups with fast system and file recovery.*

By Bruce Brown

**D**o you occasionally stare in disbelief at what you just did to mess up your computer? Or if you've ever lost a file or application because of power outages, viruses, human error, or system crashes, you know why you might need Aladdin Systems' FlashBack (\$50 street) or Wild File's GoBack (\$65 street).

GoBack provides full system, hard disk, and individual file recovery within short time frames. It operates automatically in the background with no user intervention needed, since the program protects all files.

FlashBack requires users to select files for safekeeping, but protection time span is limited only by the amount of disk space used. Both programs require that you balance protection and hard disk space.

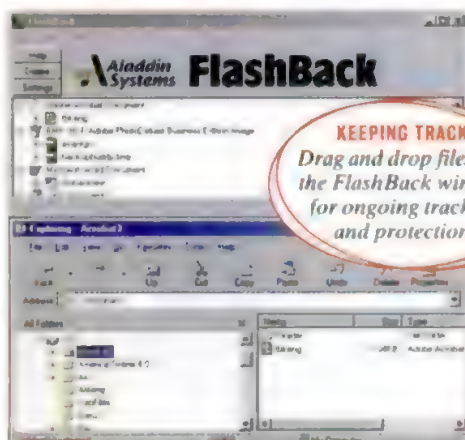
### ALADDIN FLASHBACK

Aladdin FlashBack chronologically stores application file revisions, including word processing, spreadsheet, database, image, HTML, animation, and Web page files. Revisions to any file that you move to the FlashBack window are tracked until the file is no longer accessible on the local hard disk, removable storage device, or remote server. FlashBack works better as an application or file recovery tool rather than as protection for an entire system.

FlashBack launches at Windows startup and lists revisions to its designated files with date and time stamps by application. Anytime you want to see a particular file as it existed at a point in time, click on the file version

and FlashBack launches the application, rebuilds the file, and displays the selected version.

To minimize hard disk space used, FlashBack compares each saved file with its previous version and saves only the changes that were made. In its restoration process, called *reverse differencing*, FlashBack restores files from the newest to the oldest, until it creates the



version you selected.

The older the version, the longer FlashBack takes to restore it. Storing changes only in text, spreadsheet, and database files is space efficient, but multimedia files and image file changes can require saving most or all of the original file to reconstruct historical versions.

Customized file settings let you address the nature of the application files being protected. You can define the maximum number of revisions to save, saving frequency, and set FlashBack to save a file whenever you save or close it.

Aladdin FlashBack can't restore files if your system won't boot, and it's not practical for

protecting entire hard disks, but the product is a reassuring recovery option for important files.

**Aladdin FlashBack.** Street price: \$50. Requires: 600KB RAM, hard disk space dependent on usage, Microsoft Windows 3.x, 95, or 98. Aladdin Systems Inc., Watsonville, CA; 800-850-3388, 831-761-6200; [www.aladdinsys.com](http://www.aladdinsys.com).

### GOBACK

Running parallel to Windows, GoBack tracks, stores, and displays all transactions affecting your hard disk. When a lull in hard disk activity occurs, GoBack marks its log with a System Safe Point.

If you later do damage to your machine, you can use the GoBack screen, find a Safe Point, and return your disks to the condition they were in before the problem.

GoBack requires 10 percent of your total hard disk space for a full install (partitioned hard disks are managed as one). Recovery time span (typically several days) is a function of hard disk space allocation and computer usage.

You can check how far back

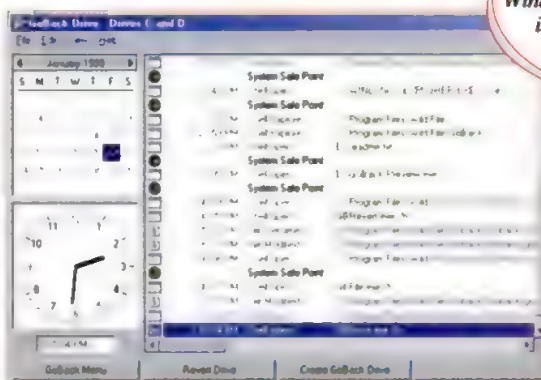
uninstalled and reinstalled if you change disk partitions.

The easiest thing to do with GoBack is to retrieve an earlier version of a file. After highlighting the file in Windows Explorer and clicking on Show Revisions, GoBack displays all recoverable file versions. You can also recover a file through the GoBack File Recovery Window, where you can sort and filter file lists.

To retrieve multiple lost files, even those moved to and deleted from the Recycle Bin, you access the GoBack Drive Window, find the closest Safe Point to a time before you deleted the files, and create a temporary GoBack Drive, which mirrors the contents of your hard disk at the Safe Point. Through Explorer you move files from the GoBack Drive to your hard disk, and then discard the temporary GoBack drive.

If your system won't boot for any reason other than a damaged hard disk, you can restore the hard disk with GoBack. If your system boots, you can restore the hard disk or selected logical drive through the GoBack Disk Revert Window.

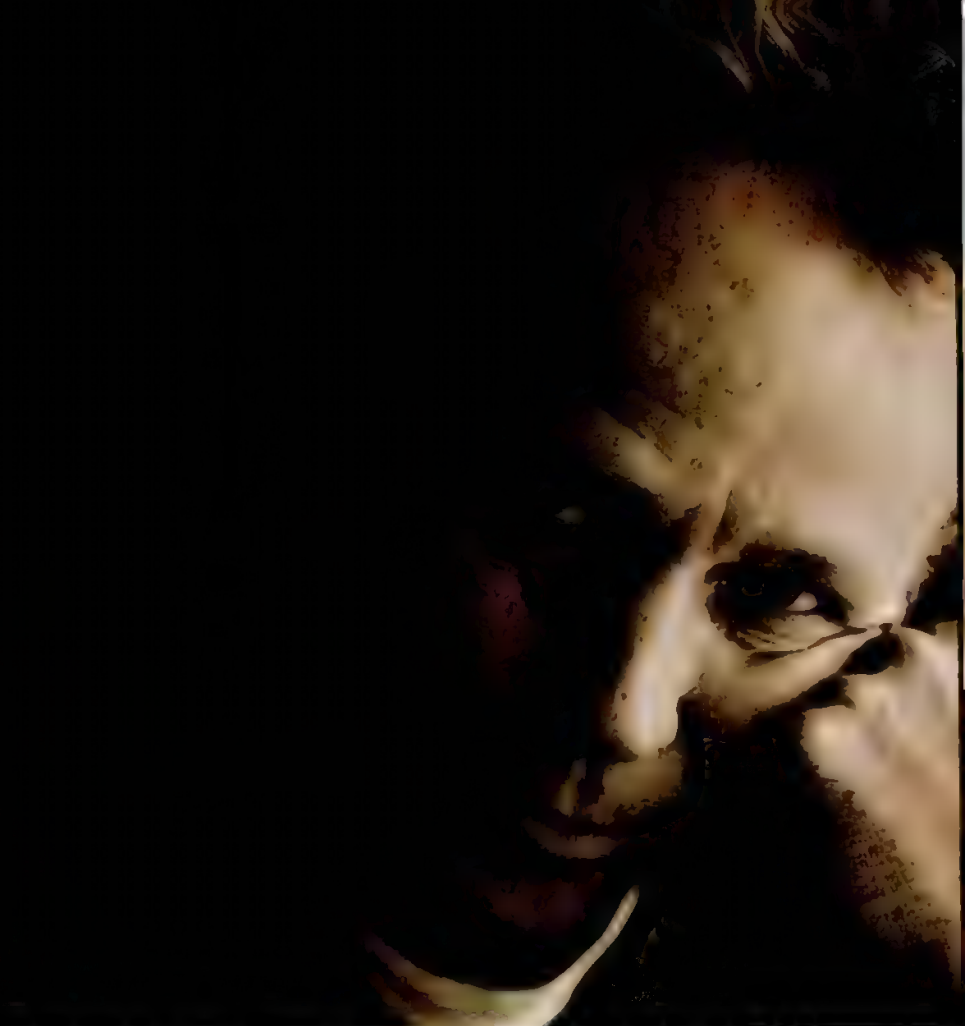
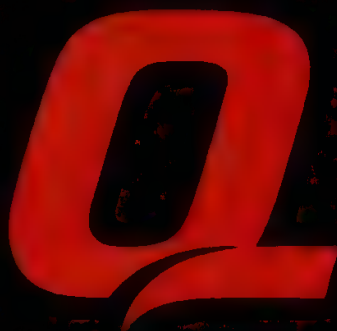
**SAFETY FIRST:**  
The GoBack Drive Window shows Safe Points in your disk activity history for disk recovery.



GoBack is no substitute for regular hard disk backups, but it will improve your chances of recovering files from immediate emergencies. GoBack's major advantage is that once you set it up, you don't need to think about it until you need it.

**GoBack.** Street price: \$65. Requires: 16MB RAM, 10 percent existing hard disk space, Windows 95 or 98. Wild File Inc., Plymouth, MN; 888-945-3345, 612-551-0881; [www.goback.com](http://www.goback.com).





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IBM Workstation







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  - Removable HDs
  - AMI LVD Ultra2 Raid 0-5 Controller
  - #9 Revolution IV 32MB AGP 2X Video
  - Sony 32X CD-ROM/Max
  - Keyboard, Floppy, Mouse
  - Full Tower 300 Watt
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SIN DUAL XEON 450MHz

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  - 128MB SDRAM Expandable to 2GB
  - Slots: (6) PCI, (1) ISA, (1) AGP
  - Sound & Ethernet 10/100 by Intel
  - (1) Matrox G200 16MB AGP Video
  - IBM 22GB 7200RPM IDE
  - Sony 32X CD-ROM/Max
  - Keyboard, Floppy, Mouse
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  - Keyboard, Floppy, Mouse
  - Intel Landesk Management Software
  - Desktop Chassis
- 649**  
Celeron 433MHz Solutions Available



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  - 3 Chan. Ultra 2 LVD RAID Cont. w/ 64MB Cache
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  - 128MB ECC Memory, Expand to 2GB
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  - 8 MB AGP Video
  - Intel Server Adaptor
  - Integrated Adaptec Ultra 2 LVD SCSI Controller
  - 9GB LVD 10,000RPM (5.0ms) Removable HD
  - 32X CDROM/Max, Keyboard, Floppy
  - 4 Bay Rackmount 300 Watt Power Supply
- 3400**

SIN DUAL XEON 450MHz-RAID 5 SERVER

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  - Slots: (6) PCI (1) ISA (1) AGP
  - Matrox G200 8 MB AGP Video
  - Integrated Intel 10/100 Ethernet
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13 Bay Rackmount Solution

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|---------------------------|-----------------------------------|-----------------------------|
| Q: (3) 9GB 7200RPM LVD HD | Q: (3) 9GB 10,000RPM 5.0ms LVD HD | Q: (3) 9GB 10,000RPM LVD HD |
| 6370                      | 6840                              | 8351                        |

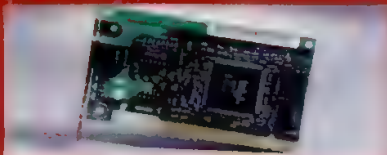
SRK 20 00W

Active/Active Controllers • Q: (2) 4 Channel RAID 5 UW Controllers • 8 230 Watt Hot Redundant Power Supplies • 128MB of Cache  
Internal Temperature Status • Power Supply Status • Cooling Fan Status • Visual and Audible Alarm

| 72GB Solution             | 72GB Solution                     | 144GB Solution              |
|---------------------------|-----------------------------------|-----------------------------|
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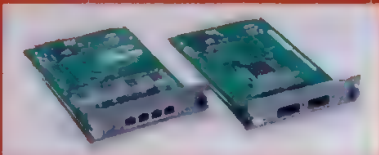
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## Real-Time Internet Banking

*First Internet Bank of Indiana makes an impressive debut online, offering real-time transactions.*

By Kathy Yakal

**O**nline banking and bill paying have many advantages over traditional methods of moving and tracking money. But most online transactions are still done via batch-processing, or posting transactions to your account in a big lump at the end of the banking day. First Internet Bank of Indiana ([www.firstib.com](http://www.firstib.com)), online since February 22, is the first state-chartered bank to operate in real time.

First Internet Bank offers familiar online services: account access, electronic bill paying, transfers and deposits, and interest-bearing accounts. The Web site is dignified and simple, with all the tools you need to establish accounts, to access them, and to dispatch transactions.

Since its operational costs are lower than those of banks with branch offices and payrolls, First Internet Bank can offer high deposit rates. At launch time, the money-market savings interest rate was 5.12 percent APY (annual percentage yield), regular savings interest was 3.04 percent, 12-month CD interest was 5.22 percent, and checking interest was 2.78 percent (all higher rates than those of most banks, according to the Bank Rate Monitor).

No-fee interest checking is available for accounts with a minimum daily balance of \$1,000. You can move your money into your virtual accounts by direct payroll deposit, Visa card, U.S. mail, or ATMs that support the MAC system (withdrawals can be made via either MAC or PLUS ATMs).

Several types of loans are available: Visa cards (12 percent interest with no grace period or 15 percent for a 25-day grace period), lines of credit (currently 9.75 percent, prime plus 2 percent), and install-

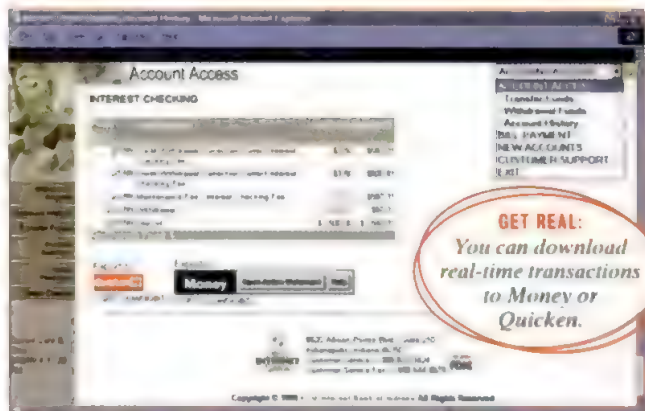
ment loans (8.5 to 12 percent). First Internet Bank also hopes to offer merchant accounts before June.

First Internet Bank's online security system has been tested and deployed in the credit union industry. Only the home page resides on the Net, not the customer database, and data must pass through two firewalls.

Many other banks offer a similar array of services to consumers and businesspeople, and at least one other claims to offer real-time transaction posting. But as yet, not one has assem-

bled all the elements of online banking as cleanly and completely as First Internet Bank of Indiana has. The combination of high interest rates on deposit accounts, real-time transaction posting, and worldwide ATM

coverage may not yet be enough reason for you to give up your bank, but it's an auspicious start. **First Internet Bank of Indiana.** Requires: 128K encrypted browser. Indianapolis: 888-873-3424; [www.firstib.com](http://www.firstib.com).



## Stylish Space Saver

*Sony incorporates its Memory Stick technology into the space-saving VAIO Slimtop PCV-L600.*

By Cade Metz

**B**uilt in part with notebook PC components, Sony's VAIO Slimtop PCV-L600 (\$2,999 direct) is ideal for those with little desktop space. Yet even when space isn't an issue, this is a brilliant home PC, offering rapid access to the Internet, adept multimedia tools, and a seminal storage technology—Memory Stick. Many PCs in its price range offer better performance and war-

ranties longer than Sony's one year, but few rival the Slimtop's slick design.

Following a recent trend, this 500-MHz Pentium III PC attaches to a unobtrusive LCD rather than to a CRT monitor. Sony's LCD—to blame for the Slimtop's high price—is difficult to read when viewed at an angle, but it provides an unusually wide screen (11.3 inches, with a height of 8.5 inches) and built-in speakers.

**LESS IS MORE:**  
The Pentium III-based Sony VAIO Slimtop combines form and functionality.



The Slimtop provides an unobtrusive system chassis to match its display. Though equipped with a 10.8GB hard disk, 128MB of SDRAM, a 56K V.90 modem, and a 24X CD-ROM, the main unit measures only 3.5 by 11 by 13.2 inches (HWD).

The keyboard offers six programmable buttons for launching oft-used applications. On our test machine, the Programmable Power Key (PPK) software used to configure these buttons wasn't operating prop-

erly, but after a few minutes on the phone with a Sony engineer, we were able to use the buttons to great effect.

The PPK software can also be used with the Memory Stick slot, which accepts 4MB or 8MB memory cards no larger than a stick of gum. These slots will soon be available with certain Sony camcorders and digital cameras and will allow you to transfer images easily to your PC or directly to an upcoming Sony photo printer. With the PPK software, you can configure the Slimtop to launch an image-editing program automatically when you insert a memory stick.

Because the unit has a much slower hard disk and graphics chip set, the Slimtop scored almost 15 percent lower on our Winstone benchmark test than the average inaugural Pentium III PC tested in our issue of March 23, but all in all, its hardware is impressive. In addition to a standard array of I/O ports, the main unit affords front and rear USB, a PC Card slot, and a volume control knob.

**Sony VAIO Slimtop PCV-L600.** Direct price: \$2,999. Sony Electronics Inc., San Jose, CA; 888-476-6972; [www.sony.com/pc](http://www.sony.com/pc).



50%

of people want a computer  
without all those fancy  
high-tech extras that they  
don't really need,  
and might never use anyway.

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of people want a computer  
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high-tech extras that they  
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- 9GB Ultra ATA 66 7200 RPM Hard Drive
- 4.8X DVD-ROM Drive & MPEG2 Decoder
- 3.5" Diskette Drive
- SoundBlaster AudioPCI 64D
- Boston Acoustics BA635 3-Piece Speaker System
- U.S. Robotics 56K<sup>1</sup> Voice Winmodem
- 8-Bay Mid-Tower Case
- MultiFunction Keyboard & Mouse
- Microsoft Windows 98
- MS Home Essentials Software
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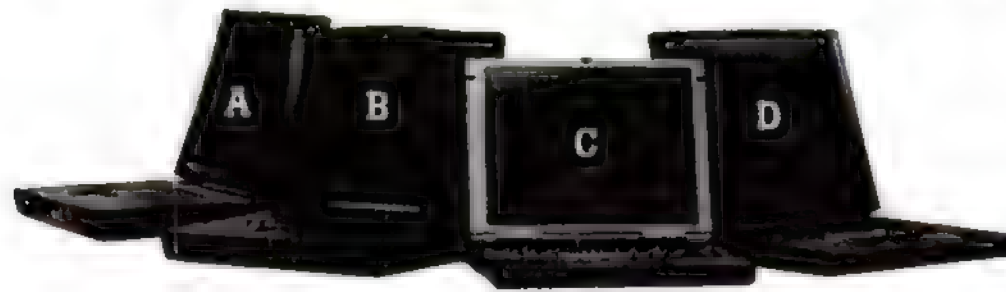
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## Web Information Handling

Using only a Web client, administrators and users can view and publish files with DataChannel RIO.

By Robert P. Lipschutz

**A**re you still using file servers to share information on your network? Consider DataChannel RIO 3.2 (100 users, \$9,500 list), a Web-based document management system. Via a Web browser, users can view content such as Microsoft Office or HTML pages and also publish them into a directory-like structure. This version of RIO adds better security, XML on the back end, and the ability to assign URLs to channels, folders, and items. RIO has not yet matured into a great product, but it certainly has potential.

### INSTALL AND CONFIGURE

RIO requires a Web server, an FTP server, and a relational database. The product works with Microsoft IIS and Netscape Enterprise Server Web servers and can use Microsoft SQL Server, Oracle, and Sybase databases.

We installed RIO on Windows NT 4.0 with the Windows NT Option Pack and Microsoft SQL Server 6.5. DataChannel seems closely aligned with Microsoft, given its codevelopment of the Microsoft Java XML parser and its compatibility and integration with Internet Explorer and the not-yet-released Microsoft Active Directory. The product is also available on Solaris; regardless of which you use, DataChannel offers two days of free, on-site installation support to get you going.

We liked RIO's content organization and distributed publishing. Content is organized into channels, folders, and items; items can be files or even URLs.

Administrators can set up channels for different departments or for project teams. Each channel can be assigned publishers that have the right to

publish items and create folders in the channel.

With this version, you can assign to channels and folders unique URLs that display when a user clicks on the channel or folder. This lets you provide a channel description or include content accessible through a URL, at the channel or folder level of the hierarchy.

Channels, folders, and items are displayed hierarchically in the left pane of the browser window. By clicking on mini-icons, channels and folders can be expanded and collapsed. We would like to see icons denoting the file type for items instead of generic-item icons.

Also, we wanted more attributes to describe content. The basics, such as author and creation date, are there, but the ability to add a long description and to define our own custom attributes would be helpful. An attribute-based search would also be welcome. Still, the interface was clean and worked well.

Users can be notified via e-mail when a new piece of content is created in one of the channels to which they subscribe. Also, a folder called What's New shows files that have been added in the last 4 hours, day, week, and month. There is no version control out of the box, so users should be sure to use a file-naming convention for new versions.

A known bug causes the channels to disappear when the window is resized using Netscape 4.x browsers. For now, you can use Internet Explorer or just tell your users not to resize their browser windows. This minor problem illustrates the difficulties in supporting various browsers.

**CHANNELING:** Administrators create and edit channels for individual users and groups.

### THE PUBLISHING MODEL

RIO supports a fully distributed publishing model, so no one has

by browsing to it on the local computer or a network-accessible drive. With a separate Windows utility called Save to the Web, users can drag and drop files directly to an icon on the Windows desktop.

User and group management is performed through an easy-to-use Web-based interface. Administrators with large Windows NT-user communities will appreciate the dynamic link between users and groups in RIO and Windows NT domains. Unfortunately, access control extends only to the channel level, not to the level of individual folders and items; more granular access control is often necessary in real-world situations.

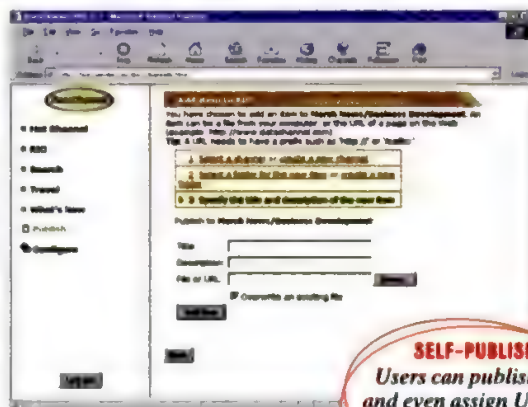
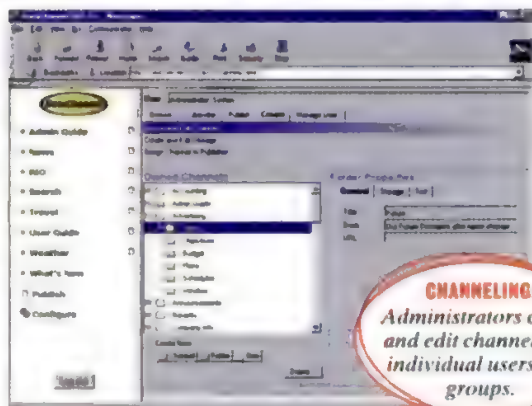
RIO is based on Extensible Markup Language (XML), but in the current release, we didn't see many of the benefits that can come from using XML. For example, XML can be used to create custom attributes or to expose an attribute-based search engine, but these features were not available in the product.

DataChannel has worked with some of its clients to integrate other kinds of content, such as legacy mainframe data and information feeds using XML. The information is mapped to XML and then stored within RIO.

Although we can see some areas for improvement, RIO offers

a clean Web-based approach to content management. We think it's worth strong consideration for your network.

**DataChannel RIO 3.2.** List price: \$9,500 for 100 users on Windows NT, \$14,500 for 100 users on Solaris. DataChannel Inc., Bellevue, WA; 425-462-1999; [www.datachannel.com](http://www.datachannel.com).



**SELF-PUBLISH:** Users can publish files and even assign URLs to channels through the HTML interface.

to rely on the Webmaster for publishing. Users are designated as publishers for specific channels by the administrator and can use several techniques to publish documents.

The simplest is a straightforward HTML publishing screen that lets users create a file by providing a title, a description, and a pointer to the file. The file is specified by typing its path or

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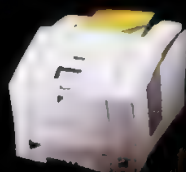
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## Changing Your Image

*Kai's Power Tools 5 adds power to your images; Ulead's GIF-X makes Web animation a breeze.*

By Luisa Simone

**T**he new release of Kai's PowerTools (\$200 street), which jumps from Version 3 to 5, isn't so much an upgrade as a new product. So different are the ten Photoshop-compatible plug-ins from their predecessors that MetaCreations has included a full copy of KPT 3 on the CD. And Ulead's new GIF-X Plugin makes adding movement and interest to your Web site easy.

### A STRONG TOOL GETS STRONGER

The magic of KPT 5 (\$200 street) is its ability to take rudimentary image-editing functions and turn them into extraordinarily powerful tools. So where ordinary

filters do exactly what their names imply, KPT 5's Smoothie, Blurrrr, and Noize filters push these functions to a new level to clean up dirty masks, to create depth-of-field effects, and to generate complex patterns, respectively.

Some of the filters make previously impossible effects possible. FiberOptix, for example, can grow fur, hair, and other strand-based particles in a fraction of the time it would take to paint them manually. And FraxPlorer, a module that lets you explore fractals, has been enhanced with a nearly infinite zoom (up to  $10^{300}$ ), speedier calculations, and a host of rendering styles that make fractals truly useful for creating original patterns.

KPT 5's new ShapeShifter module produces 3-D beveled objects that are perfect for Web buttons and gizmos. In contrast with other programs that stress ease of use, Kai's ShapeShifter offers such advanced functions as custom bevels, secondary

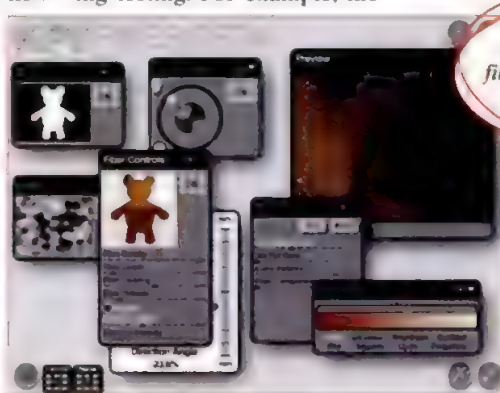
masks, and internal reflections to create interface objects that are visually arresting. As with all KPT 5 filters, ShapeShifter works with any selected layer in a Photoshop document and preserves transparency information—making compositing complex images a snap.

A few glitches emerged during testing. For example, the

face is that the multitude of panels can clutter the screen.

To employ the filters productively, users must be professional illustrators or diehard enthusiasts. But for that select group, Kai's Power Tools 5 is an indispensable plug-in.

**Kai's Power Tools 5.** Street price: \$200; upgrade, \$100. Requires: 32MB RAM; 50MB hard disk space; Windows 95, 98, or NT 4.0 or later. MetaCreations Corp., Carpinteria, CA; 800-846-0111; [www.metacreations.com](http://www.metacreations.com).



#### FUR REAL:

With KPT's FiberOptix filter, you can quickly produce effects such as naturalistic fur.

#### SIMPLE MAGIC

Ulead's GIF-X Plugin provides 12 automated effects for animated GIFs. Because GIF-X (\$29.95 direct) is a plug-in, it will work

its magic from within any image-editing program that supports the Adobe Photoshop 32-bit plug-in specification.

GIF-X makes manual frame-by-frame animation unnecessary by providing true keyframes. Minimally, you must set up the parameters for the start and stop of an animation to

controls within GIF-X include the ability to set the number of frames in an animation, to create seamless loops, and to save a group of parameters as a Preset for later reuse.

The individual effects range from straightforward rotations and color cycling to more complex motion sequences, such as a rippling flag or a rotating 3-D cube. All of the effects offer powerful controls. For example, when rotating an image, you can blur it to increase the sensation of motion.

When used with an image-editing program, GIF-X creates simple, single-object animations. You can't apply multiple effects to the same animation, nor can you composite an animation over a different background. These limitations don't apply if you use GIF-X as an add-on to Ulead GIF Animator.

We liked that GIF-X can output animated GIFs directly from the plug-in dialog box, even though it offers only basic options (such as color reduction, transparent backgrounds, and interlacing). The plug-in can also generate a still image or produce sequenced BMP files.

To create complex animations with multiple moving objects or to squeeze a file size for optimum performance on the Web,

you really need a more robust and more expensive animation program (such as Adobe ImageReady, Macromedia Fireworks, or Ulead GIF Animator). But if you want to transform a single image into a complete animation with a few mouse clicks, check out this low-cost alternative.

**Ulead GIF-X Plugin.** Direct price: \$29.95. Requires: A host program that supports the Adobe Photoshop 32-bit plug-in API. Ulead Systems Inc., Redondo Beach, CA; 310-297-5755; [www.webutilities.com](http://www.webutilities.com).



#### MOVING EFFECT:

The 3-D map filter in GIF-X lets you rotate a cube in space.

have GIF-X interpolate (or *tween*) all the necessary frames. You can make any effect more complex by creating additional keyframes with subtle changes to the settings. The universal con-



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## One-Stop Phone-Line Networking

*The Compaq Home Phonenumber Networking package emphasizes easy setup and PC and Internet connectivity.*

By Bruce Brown

**B**y integrating essential hardware and software components in an easy-to-buy, easy-to-configure package, Compaq's Home Phonenumber Networking (\$3,896 list, as tested) adds value beyond the cost of the individual components. A variety of bundles are available, but all include some basic elements: two Presario PCs with monitors, 1-Mbps Home Phonenumber Network cards, and WinGate software for shared Internet access via a single Internet connection.

Home Phonenumber Networking configurations start with a Compaq Presario 5600i PC (which acts as the server) and a Presario 2281 Client PC. Bundle prices range from \$2,494 to \$3,896 (list), depending on the configuration of the Presario 5600i; we tested the top-of-the-line system for this evaluation.

### THE BUILDING BLOCKS

A fully loaded Presario 5600i starts off with a 450-MHz Pentium II CPU, 128MB of RAM, a 14.4GB hard disk, a 6X DVD-ROM drive, a 16MB Diamond Viper 550 graphics board, integrated Home Phonenumber Networking, and 10-Mbps Ethernet. Compaq then adds a 1.5-Mbps Max Digital modem, an Iomega Zip Drive, JBL Pro speakers, an Aureal 8820 PCI audio card, and a 15-inch Compaq FP700 digital flat panel monitor.

The Presario 2281 Client PC features a Cyrix M II-333 CPU, 32MB of RAM, a 4GB hard disk, a 32X CD-ROM drive, a 56K v.90 modem, a 17-inch monitor with speakers, and its own Diamond HomeFree Home Phonenumber Networking card. Like the 5600i, the 2281 has an Easy Access Internet

keyboard, with multimedia controls and programmable keys.

This client Presario is configured identically in all bundles, but you can save money on the 5600i by configuring it to your specifications; slower CPUs, smaller hard disks, and different graphics solutions are available. If you already have a PC to use as a client, you can buy a \$49 Diamond HomeFree Home Phonenumber Networking card rather than the Presario 2281 (a \$929 option with monitor). The Compaq Online Store can help with system configuration and lets you quickly check prices of various configurations.

### TECHNOLOGY JUNCTION

The Home Phonenumber Networking package joins several technologies, including shared Internet access and the potential for

from Compaq or from third-party vendors.

The Compaq system also uses Deerfield.com's WinGate Home 3.0 Internet-sharing software. WinGate enables three PCs to access the Internet simultaneously using a layered service provider technology (rather than proxy sharing). In practice, more than three PCs can be connected to the Internet at the same time with WinGate, since the shared-access limit applies only when actively uploading or downloading data.

WinGate can work with analog telephone, cable, xDSL, and digital satellite Internet connections, although only one type of access can be configured and active at one time.

The WinGate software also performs other functions. Parents can use Win-

### HOOK UP:

Compaq's Home Phonenumber Networking's status window shows information about shareable drives and peripherals.

Gate to track Web sites visited by each PC on the network and to log downloaded files.

### HIGH-SPEED CONNECTIONS

Except for standard analog modems and the usual array of ISP start-up programs preloaded on both PCs, Compaq doesn't provide its own Internet-access solution. Our test system had a 1.5-Mbps Max Digital modem installed, which can be used for 56K v.90 connections today and can be upgraded to support G.Lite (formerly called Universal ADSL) in the future.

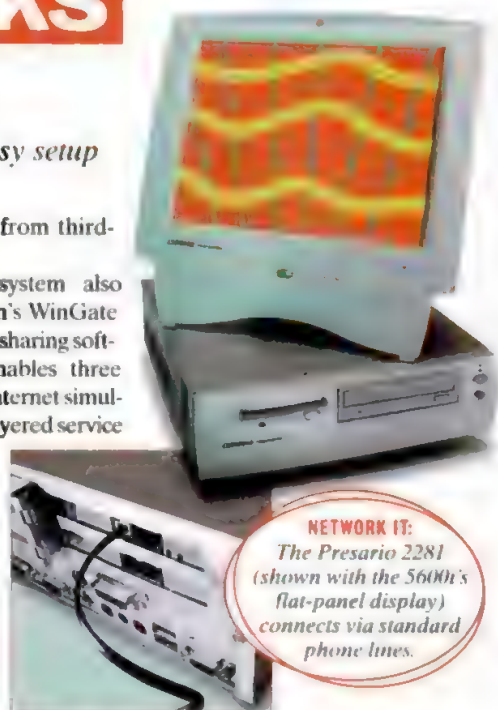
Be aware, however, that G.Lite is not an approved standard yet, and that service is not available anywhere in the U.S.

If you want broadband service, you have to bring the service connection to the desktop. If you want a cable modem, for example, you'll need to contract with a cable provider for a truck roll to check and/or install the cabling, provide the cable modem, install a second network card in the Presario 5600i server, and configure the software. Then, WinGate can easily be configured to let all users on the network share the access.

In the future, Compaq plans to have retail kiosks and Web site services for determining what broadband technologies are available for specific addresses, preferably with help in contacting providers and starting the acquisition process. But for now, you have to do all of the legwork on your own.

### SIMPLE SETUP

Setting up the system is a matter of plugging cables into a few pieces of hardware and installing and then running one program on each PC. Compaq makes the process even easier with a clearly illustrated quick-setup guide.





This is augmented by a Home Network Feature Guide, which provides step-by-step instructions for connecting the pieces, running the home network setup software, using the network, and adding more client PCs.

After you set up the computers and connect the Home Phoneline Network cards to telephone jacks, you boot each PC and run software provided on a CD-ROM. Once you specify whether each computer is a client or the server and how that computer should be identified (with the aid of a software wizard), the proper software is installed on each PC.

Next, you run the Home Network Setup software—first on the server and then on the client. During this process, you decide which drives and attached printers to share and whether or not the client PC will be able to share Internet access. The entire process, which is aided by wizards, ran quickly and smoothly during our tests.

You have a choice with the

Home Phoneline Network: You can plug the PCs together using Category 5 Ethernet cables and a network hub (not provided) or you can use regular phone lines, but you can't use a mixture of the two. (Both machines have RJ-11 and RJ-45 jacks, but only one is usable at a time.)

If you connect via phone line and have multiple phone lines in your house, be sure to plug all PCs on the Home Phoneline Network into the same line.

Up to 254 PCs with Home Phoneline Network cards can theoretically be plugged into the same phone line, although performance (which is apportioned on demand) would be abysmal. With 3 to 5 PCs, however, for simple printing and file sharing, any performance delay caused by the 1-Mbps bandwidth is more than overshadowed by convenience.

#### GETTING ONLINE

Setting up Internet access sharing is as easy as configuring file



**LAN DO:**  
The Presario 5600h acts as the server for your small home network.

and printer sharing, again aided by a software wizard. But there are limitations to how you can access the Internet. For example, the server can use America Online to access the Internet, and that connection can be shared, but because only one user per account can access AOL at a time, client PCs on the same network will not be able to dial in to AOL via shared access.

Even AOL's Internet component will be restricted, since you can't check AOL e-mail, for example, if someone else on the

same account is connected to AOL at the same time. This would be the case if the server dialed in to AOL, unless you have separate AOL accounts—not just different screen names.

Compaq's Home Phoneline Network-

ing isn't the best solution for all families that want Internet access, but it's currently the easiest way to bring in two PCs, set them up, and start sharing peripherals, files, and Internet access immediately. If you need more than 1-Mbps bandwidth or if you want AOL access from more than one PC, you're better off assembling components and software on your own. Compaq has hit its design goal on the head, however, with a well-integrated, easy-to-use, affordable system.

**Compaq Home Phoneline Networking.** List price: \$3,896. Compaq Computer Corp., Houston; 800-345-1518; [www.compaq.com](http://www.compaq.com).

## Turn Your TV into a Videophone

Looking for a quick and easy videophone solution? InnoMedia's InfoView (\$350 street) just may be the answer. It connects with other InfoView installations or any TV- or PC-based H.324-compliant videoconferencing system to exchange full-motion video and voice over standard phone lines. Without incurring additional local or long-distance phone charges, you can view a fair-quality image of the other party, capture still-frame images, and record to a VCR.

The InfoView unit is about the size of a hardback novel, with a 0.25-inch CCD color camera built-in up front, as well as a 33.6-Kbps V.34 modem (with support for V.80) in the back. A power adapter, audio/video cable, and generous 18.5- and 26-foot phone cables are also included. In under 10 minutes, we connected InfoView to an analog phone line, TV, touch-tone phone, and power outlet. One of our two test units arrived with the power button retracted into the case, but it took us only 3 minutes using a screwdriver to fix the problem. Otherwise, both units worked exactly as documented.

After you set the connected TV to video mode, you navigate InfoView's menu using the connected telephone's keypad. To

make a video call, just dial a phone number; activate InfoView, and upon connection, you see yourself and the other party in a split screen. You can also switch to a full-screen view of just the other party. And if you have Caller ID service, the other party's phone number appears on your TV screen.

At the highest picture-quality level (of five levels that balance speed and image quality), in testing with wired phones and also with 46-MHz analog, 900-MHz digital, and 900-MHz digital spread-spectrum portable phones, InfoView worked acceptably. The remote party's picture is not as clear as the local picture, and full-motion video had a latency of 1 to 3 seconds in testing.

The camera has a maximum resolution of 352-by-288 (using the *Common Interchange Format* or CIF video standard) and also supports 176-by-144 (QCIF). Through the local phone pad you can pan, tilt, and zoom both local and remote InfoView cameras. To monitor a remote location, InfoView has an Auto-Answer option that automatically establishes a connection with any incoming call from a compatible videoconferencing system.—BB  
**InfoView.** List price: \$350. InnoMedia Inc., San Jose, CA; 888-251-6250, 408-432-5400; [www.innomedia.com](http://www.innomedia.com).





## Priority Mail

*Mustang Software's IMC ensures your customers' e-mail inquiries get the attention they deserve.*

*By Robert P. Lipschutz*

**I**magine if no one answered your 911 call. On the Internet, an e-mail request for help may not be of life or death importance, but it might be the key to keeping or losing a customer. Mustang Software's Internet Message Center (IMC) Enterprise Edition 2.3 can help customer service departments better respond to customer e-mail questions directed to general e-mail addresses (*support@* and *sales@*, for example).

**IMC adds structure, accountability, and reporting to your existing e-mail system. We would like to see more in the way of intelligent auto-responses and auto-suggestions, but we were impressed with how cleanly the product addresses and solves problems. Put this one on your short list.**

Many companies don't respond to e-mail in a timely fashion—or at all. Imagine a salesperson simply turning from you and walking away, a customer service representative hanging up on you, or a letter you've sent going unanswered. In the new electronic world, good customer service demands that companies respond to customer e-mails—it's often the only communication channel customers have.

## HOW IMC HELPS

IMC provides a more structured approach. The IMC server queries your POP3 server for new messages to the general accounts you configure. As it extracts these new messages, the server can send an acknowledgment to the customer that might include information such as an expected response time.

IMC then creates a tracking number for each message and assigns the message to a pool. There are many ways to assign a message to a pool. First, the pools are based on e-mail addresses; for example, *sales@* and *support@* can be fed to separate pools. Next, IMC can perform a subject-line scan on incoming messages to determine the appropriate pool. If no desired match is found or no subject-line fil-

ters are defined, the message is routed to the default pool.

You can also write scripts that check the body of an e-mail message for keywords or for combinations of words. Pools can be set up in many ways. For instance, a computer company might have a pool for hard disk questions and one for monitor questions. Customer service agents pull messages from their assigned pools and then take appropriate action.

You can choose to have your questions answered using the IMC response library, which is a simple set of text blurbs organized in folders that a customer service agent may paste into an e-mail message. We would like to see an auto-suggestion feature on top of the response library. If the text of the e-mail message about a monitor ques-

tion included the word *sound* or *speaker*, the auto-suggestion could bring up responses pertaining only to monitors with speakers.

By clicking on the history button in the Agent application, the agent can view both the current message thread between customer and agent and all previous e-mails sent by the customer. Once an agent is assigned a given message, all future correspondence pertaining to this incident will go the same agent.

an agent is unable to answer the question, he

or she can forward it on to another pool, for example *monitors—advanced questions*, or to a specific person. For instance, Mr. Flatpanel may be the known expert.

### The IMC server

agent, or track the history of a request. There is also a Microsoft Outlook add-on and a tool called IMC Architect, which can be used to embed the agent software as ActiveX controls into an existing customer service application. Agents use the existing e-mail client to send and receive e-mail messages.

## TRACKING SUCCESS

A wise person once said that if you don't measure something, it won't happen. IMC includes both real-time monitoring (IMC Monitor) and reports (IMC Reports) to track how well individual customer service agents are doing and how the group is doing as a whole. You can set your own service levels and then monitor the system to make sure those service levels are met.

Messages are color-coded to indicate how long they've gone unanswered. A supervisor can keep track of individual agents in real time. The Web-based reports generate useful

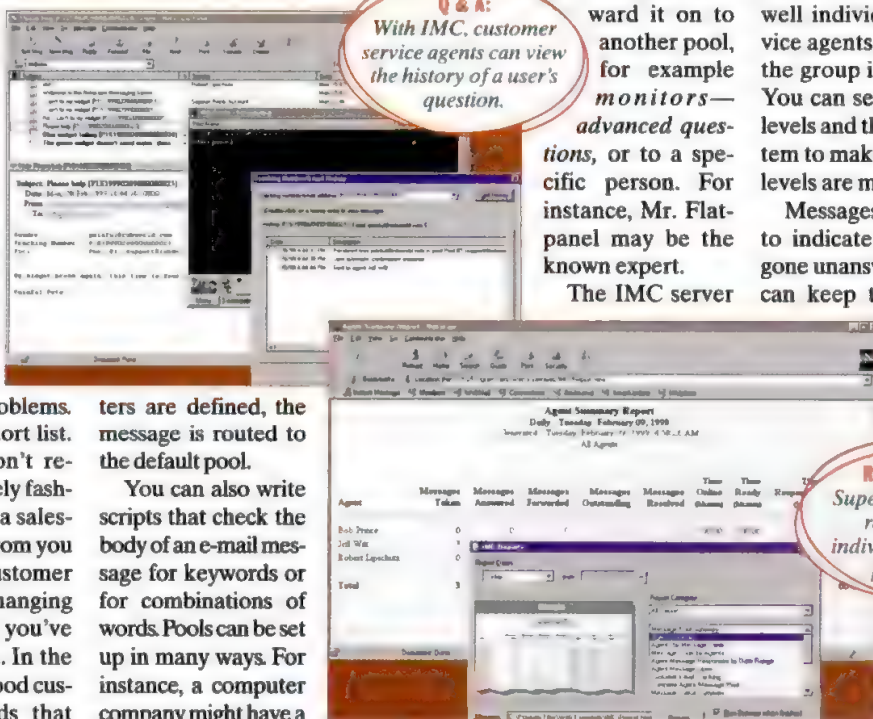
**RESPOND TO ALL:**  
Managers can create reports to track individual and general performance.

information on just about any parameter—for example, how long

on the average answering messages in the *monitor questions* pool is taking.

**IMC adds order to chaos. It or a product like it should be a part of your company's customer service department.**

**Internet Message Center Enterprise Edition 2.3.** List price: \$10,000, including two agent seats; \$250, each additional agent. Mustang Software Inc., Bakersfield, CA; 800-999-9619, 661-873-2500; [www.mustang.com](http://www.mustang.com); 408 at [www.pcmag.com/infoink](http://www.pcmag.com/infoink)





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A black lizard is shown climbing a curved, textured surface that resembles a computer screen or a piece of equipment. The lizard is positioned on the left side of the frame, with its body and legs visible as it moves upwards.

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## Speedy SOHO Ink Jet Printers

*The Canon BJC-6000 Series Color Bubble Jet Printer and Epson Stylus Color 900 top each vendor's line of speedy, low-cost, high-quality ink jets.*

By Bruce Brown

For home-printing or high-volume small businesses, Canon Computer Systems and Epson America have new ink jets to offer. The Canon BJC-6000 Series Color Bubble Jet Printer (\$250 street) and the Epson Stylus Color 900 (\$450 street) are not only faster than their predecessors but produce higher-quality prints as well.

Epson's printer is a speed demon that produces great output in all modes; it boasts both parallel and USB connectors. The Canon printer is slower but outputs fine text, graphics, and photo prints, and it features single-color ink tanks for economical consumables use.

### CANON BJC-6000 SERIES COLOR BUBBLE JET PRINTER

You can economize with the Canon BJC-6000 Series Color Bubble Jet Printer. But there's no big sacrifice of speed or image quality: The BJC-6000 is competitive on both counts.

The BJC-6000's ink-on-demand process produces 1,440-by-720-dpi images at rated maximums of 8 ppm in black and 5 ppm in color. For text and color graphics printing, the standard 160-nozzle black and CMY color cartridges (48 nozzles per color) are installed at the same time; separate ink tanks for cyan, magenta, and yellow snap into the color cartridge. Per-page costs are rated at 3 cents for text and 9 cents for color graphics.

With all trays extended, the BJC-6000 measures 11 by 18.5 by 22.5 inches (HWD). The input tray holds up to 130 sheets of paper or 10 envelopes. The printer includes watermark and collating-order settings, in addition to standard settings.

This unit produced high-quality output when printing text, graphics, or color photos. High-resolution

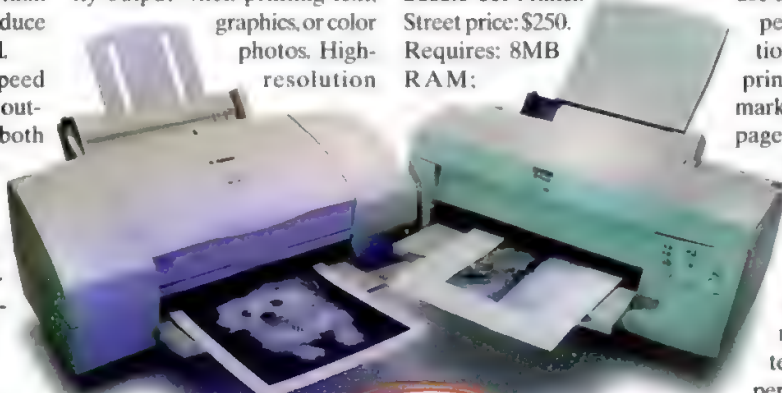
including Canon's Design Essentials (graphical templates) and WebRecord (a Web page-printing manager).

The Canon BJC-6000 Series Color Bubble Jet Printer offers economy and value—a savvy color printer package.

**Canon BJC-6000 Series Color Bubble Jet Printer.**

Street price: \$250.

Requires: 8MB RAM;



#### DOUBLE DUTY:

You need a magnifying glass to find any rough edges on output from these printers

40MB hard disk space; Windows 95, 98, or NT 4.0

or later. Canon Computer Systems Inc., Costa Mesa, CA; 800-652-2666; [www.ccsi.canon.com](http://www.ccsi.canon.com).

### EPSON STYLUS COLOR 900

The Epson Stylus Color 900 produces fabulous color images with Epson's PicturePerfect Imaging System. This printer puts three picoliters of ink in each ink droplet, produced by the 192-nozzle monochrome head and a color head with 96 nozzles each for cyan, magenta, and yellow. These tiny droplets

aid in color accuracy and fine detail at the printer's maximum 1,440-by-720-dpi resolution.

The Stylus Color 900 has both parallel and USB port connections. In maximum speed modes, this unit is rated at 12 ppm black and 10 ppm color, significantly faster than its predecessor, the Stylus Color 850.

Measuring 12.8 by 18 by 22.5 inches (HWD), the Epson unit is designed for heavy-volume use and is rated at 5,000 pages per month. Formatting options selectable from the printer driver include watermarks and four-up printing. Per-page costs are rated at 3 cents for text and 7 cents for color graphics.

Test prints of text output were clear and very black, with roughness on the edges visible only via a magnifying lens. On our tests, the Stylus Color 900 performed very well with large documents and photos. In USB mode, it printed our 25-page sample in 3:10 and our photo in 4:04; both figures are nearly 2 minutes faster than those of the Canon unit.

The Epson's software bundle includes Polaroid PhotoMax Pro for PC by Arcsoft and a choice of two more programs from a variety of categories.

For heavy workloads in particular, the Epson Stylus Color 900 is the right tool at the right price.

**Epson Stylus Color 900.** Street price: \$450. Requires: 16MB RAM; 50MB hard disk space. Epson America Inc., Torrance, CA; 800-463-7766, 310-782-0770; [www.epson.com](http://www.epson.com).

### PERFORMANCE TESTS



## Ink Jet Printers

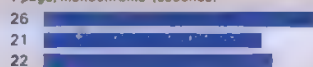
Canon BJC-6000

Epson Stylus Color 900 (parallel)

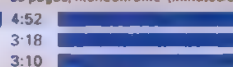
Epson Stylus Color 900 (USB)

#### Microsoft Word Test

1 page, monochrome (seconds)

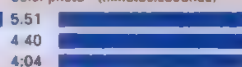


25 pages, monochrome (minutes:seconds)



#### Graphics Test

Color photo\* (minutes:seconds)



\* A 4.5 x 7-inch 300-dpi, 8-MB image, printed with Photoshop LE at the highest printer resolution on the vendor's own glossy photo paper



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## Find the Weak Links

*Tetranet's essential link-checking tool, Linkbot Pro 4.0, can now find more than dead links.*

By Troy Dreier

**A**fter years of providing reliable, indispensable service, Tetranet Software's Linkbot (single user, \$295 list) has become an essential tool for Webmasters. With one quick search, it can round up all the broken links at a Web site. Now, Linkbot Pro 4.0 helps site managers find more than just dead links.

Linkbot Pro 4.0 offers simple HTML validation and checking for missing titles, metatags, and correctly structured comment tags, among other features. If you're checking a local copy of your site, you can fix those problems from within Linkbot. (Version 4.0a fixes an error with HTML validation. Be sure to download the fix at [www.tetranetsoftware.com/download](http://www.tetranetsoftware.com/download),

as the problem could cause data loss.)

Most of this version's improvements expand Linkbot's link-checking ability. The concise HTML reports that Linkbot generates now feature a graphical report that shows what type of errors a site has; it's more eye candy than a useful feature, though. Linkbot has always checked for pages that are more than 50K, but it now checks for pages that are less than 3K as well. Version 4.0 also shows which pages are deep, meaning that you'd need to click at least five links to get to those specific pages.

Linkbot Pro 4.0 has an improved engine that's optimized to check links

more quickly. But on our tests, this didn't bear out. Running Linkbot 3.6 and 4.0 in similar conditions gave nearly identical results. Still, using 10 connections on a T1 line, both averaged around 250 links per minute.

When we ran Linkbot Pro 4.0 on the local copy of our site, we averaged more than 1,000 links per minute. Though the software has been tuned to use less memory, Tetranet recommends 64MB to check 50,000 pages

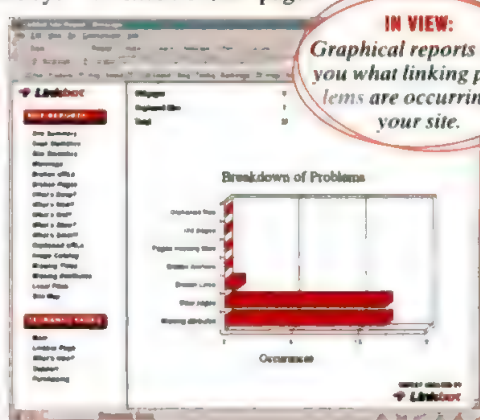
and 256MB for 1 million pages.

Prior versions of Linkbot have choked over URLs created in JavaScript. With a little fine tuning, Version 4.0 can be set to understand what a site's JavaScript URLs look like within a script.

For the next version, we'd love to see better user interface controls. Linkbot Pro 4.0's controls should be much more intuitive. Nevertheless, Linkbot is a must-have tool. Tetranet also offers a

free version, Linkbot Express, for hobbyists running personal Web sites.

**Linkbot Pro 4.0.** List price: Single-user license, \$295. Requires: 16MB RAM; 10MB hard disk space; Microsoft Windows 95, 98, or NT. Tetranet Software, Kanata, Ontario, Canada; 888-245-5550; [www.tetranetsoftware.com](http://www.tetranetsoftware.com); 402 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).



## First-Rate Updates

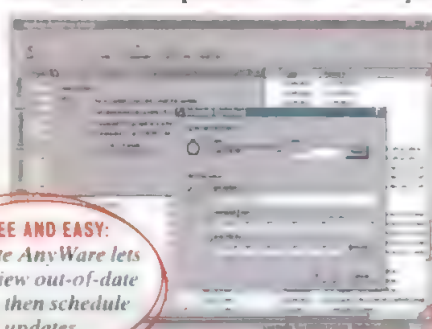
*Easily discover and update outdated drivers with Update AnyWare from GreenTree Technologies.*

By Stephen W. Plain

**O**ne inevitable by-product of today's component-oriented operating systems and applications is the dizzying array of drivers, custom controls, and code modules that silently multiply on your system. Keeping them up to date is a daunting task, but system-update utilities and services greatly ease the pain. GreenTree Technologies' Update AnyWare is the only major contender to provide a free solution.

The Update AnyWare package comprises a client program, an ActiveX component, and a Netscape plug-in, and all are available as a free download from GreenTree's Web site ([www.updateanyware.com](http://www.updateanyware.com)). The ongoing service is also free of charge.

Update AnyWare profiles your system, and based on GreenTree's own file database on its Web site, lets you download updates for applications, drivers, and components. You



can get individual updates or batch scheduled downloads for off-peak hours. Since you can use the service from any Web browser without the standalone client once you're a registered user, you can

profile any system with an Internet connection.

The Update AnyWare client uses a clean interface to make profiling quick and easy. Three tabbed windows present the key information: the results of the latest profile run, a history of profiling and downloading, and a detailed list of downloaded files. When you click the Profile button on the toolbar,

the client downloads an encrypted list of current file versions and then searches your hard disk for all supported applications and components. You then view the list of out-of-date files and decide which to update.

Green Tree claims that over 13,000 product entries are supported. The company uses FTP links to software vendors' sites to provide the updates.

We tested Update AnyWare on both Windows 95 and 98

systems; it was quite easy to use. The program rightly identified system and peripheral drivers that were out of date, as well as applications that could stand to be updated and missing operating-system patches. Downloading was smooth, and the scheduling feature was quite useful.

Update utilities can be helpful, but they can also cause new headaches. Aggressive changes to drivers and components can draw out new incompatibilities. Since Update AnyWare doesn't let you reverse upgrades, you should take care to back up your files. Nevertheless, this package is a great tool to add to your regular arsenal, and the price is definitely right.

**Update AnyWare.** Free download. Requires: 8MB RAM, 5MB hard disk space, Microsoft Windows 95, 98, or NT. GreenTree Technologies Inc., Huntington Station, NY; 800-257-7708; [www.updateanyware.com](http://www.updateanyware.com); 403 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).



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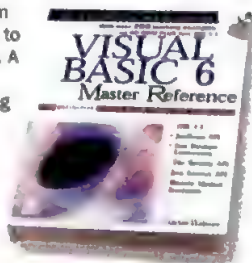
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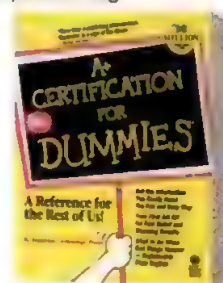
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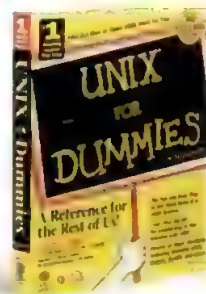
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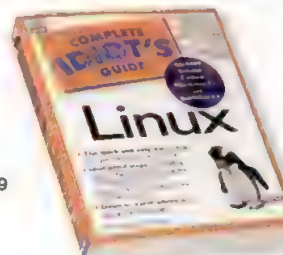
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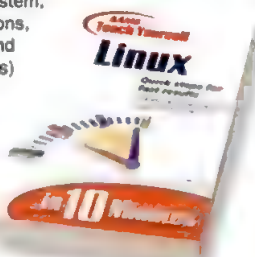
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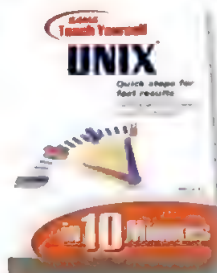
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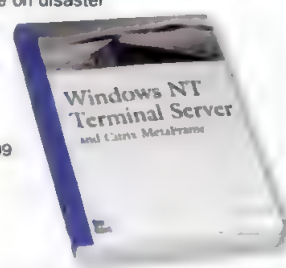
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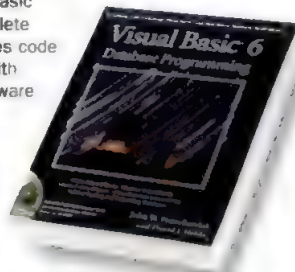
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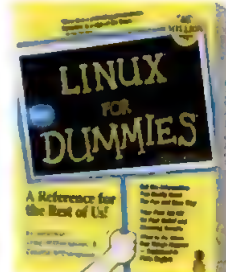
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Harness the power of your computer's capabilities with a crash course in Linux. This straightforward companion encourages tinkering and teaches specifics like installation and configuration, setting up Web servers and using X-Windows point-and-click. Bonus CD-ROM includes Red Hat Linux 5.0 software. (IDG)

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## SigmaPlot Adds Macros

*The major addition to SPSS' leading graphing product is a VBA-compatible macro language.*

By Barry Simon

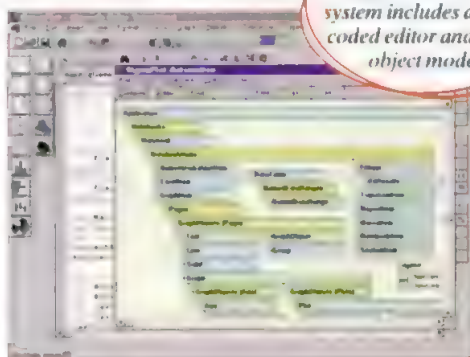
**S** PSS' SigmaPlot has long been the leader in scientific and technical graphing. Although the product has had a language to allow manipulations of data in worksheets, it has lacked the automation tools found in its leading competitors. With SigmaPlot 5.0 (\$595 list), SPSS remedies this in spades. Because of macro recording and the use of a standard language (rather than the proprietary languages used in other programs), SigmaPlot now sets the standard for scientific graphing.

The new macro system is based on Sax Software's VBA-compatible language. This development environment does not have some of the spectacular IntelliSense features of the real VBA (object dropdowns, for example), but it does include a color-coded editor, integrated debugger with breakpoints and watch variables, object browser, and dialog editor. The object model for the language exposes all the major features and dialogs in the product.

Especially welcome is the record mode, which is both a valuable learning tool for serious projects and a lead-in for quick and dirty macros the user can record and assign to the SigmaPlot menus. We had no problem running the graphing wizard through a standard set of choices and adding a useful command to the menus without any coding at all.

SigmaPlot's graphing wizard has long been a model of good design: simplicity and power with a few mouse clicks. Unfortunately, the new function-plot-

ting wizard and the earlier regression wizard are disappointments, because they force the user to supply snippets of multiline



**GRAPHICAL:**

SigmaPlot's macro system includes a color-coded editor and a rich object model.

code in places where many other programs require only a formula defining a function.

SPSS keeps the features that have made SigmaPlot a leader. Excel worksheets can be opened in native mode, for example. You can also organize multiple data sheets and plots into projects, although you can include only one Excel sheet that acts as an OLE client.

The multitabbed graph-customization dialog, with its subdialogs, remains a paradigm of intelligent organization. You can make plots where the symbols, symbol colors,

and symbol sizes depend on extra data parameters. There is a wide array of 2-D graphs, including ternary and box-whisker plots and the basic 3-D graphs.

The soon-to-appear new versions of Axum and Origin present formidable competition to SigmaPlot, but this product remains the choice for occasional users, and now it's also the best choice for those who want to use macros to make elaborate automated graphing systems.

**SigmaPlot 5.0.** List price: \$595 (\$199 upgrade). Requires: 32MB RAM; 20MB hard disk space; Microsoft Windows 95, 98, or NT. SPSS Inc., Chicago; 800-543-2185; [www.spss.com](http://www.spss.com).

## Your Pictures—on TV

*The Avicor Digital Photo Album lets you view your digital camera images on your TV.*

By Daniel Grotta & Sally Wiener Grotta

**E** quip a television set with a floppy disk drive and the ability to display and arrange images from a digital camera or 3.5-inch floppy disk and what you have is the Avicor Digital Photo Album (\$250 street). The Avicor is a must for those wishing to display digital images on big-screen TVs or for ultra-easy downloading from a digital camera.

The book-size Avicor sits on top of your television or VCR and has video and audio ports and plugs for interfacing with most TVs and VCRs. The Avicor comes with an RCA A/V cable, but if your TV set supports S-Video, you'll have to provide your own cable. The parallel port is not currently supported, though Avicor says it will provide free

printer drivers when available.

Avicor presently supports 33 cameras from major manufacturers. You must install the appropriate driver from the bundled disk or download it from Avicor's Web site.

All functions are activated by the Phaser-looking in-



**MUST SEE:**

Pop a floppy disk into the Avicor Digital Photo Album and view your photos on TV.

frared remote control. Using the remote to navigate through the Avicor is so simple and logical that even a technophobe can handle it.

Each image appears as a thumbnail in a contact sheet metaphor, called an *album*. Press the center button on a thumbnail and the full image is displayed on your TV. Decompressing takes between 15 and

48 seconds for each image, which is then written into memory.

The Avicor both reads and saves JPEG files on floppy disks and can erase and format them as well. The only image editing tools, however, are rotate and zoom. A zoomed image can be saved, but the thumbnail will continue to display the original full image.

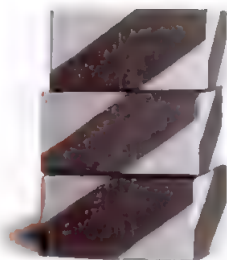
You can create JPEG images in a program like PowerPoint, change their order using Avicor, and then save them to a floppy disk. This is useful for creating inexpensive auto-play presentations.

The Avicor is both easy and fun to use, and image quality is as good as on your TV. Although users have no control over the degree of compression, saved JPEG images opened flawlessly on our test PC, without quality degradation.

The Avicor Album is the easiest and fastest way to view and save your digital images.

**Avicor Digital Photo Album.** Street price: \$250. Avicor Inc., Saratoga, CA; 800-604-5700, 408-399-7540; [www.avicor.com](http://www.avicor.com).

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## More than a Modem

*The Eicon Diva LAN Modem turns out to have more features than its name implies.*

By Les Freed

In spite of its name, Eicon Technology Corp.'s Diva LAN ISDN Modem (\$495 list) isn't a modem at all. Like 3Com's similarly named and priced OfficeConnect 56K LAN Modem ("Making the Connection," January 5, 1999), the Diva combines an ISDN router and a workgroup-size four-port Ethernet hub into a single device that provides Internet and remote LAN access to a small group of users.

The Diva is a small box with ten status LEDs on the front, and all of the ISDN, Ethernet, telephone, and power connectors in the rear. Two RJ-11 phone jacks let you connect phone, fax, or answering machine lines to the Diva, so you can use the ISDN line for voice and fax calls. The Diva can connect to two remote sites at once—one on each ISDN B channel—to provide Internet and remote LAN access at the same time.

The unit is one of the easiest routers we've ever set up. Eicon provides all the cables you need, and the cables are color-coded to match the port connectors. A Web-based setup wizard walks you through every step of the software installation and configuration. As with many newer ISDN devices, the Diva asks for your ISDN phone numbers and then attempts to determine the rest of the ISDN configuration data on its own. We tested the Diva on two ISDN lines—one with AutoSPID and one without—and the Diva configured itself correctly both times.

Once you've configured the phone line, Eicon provides more wizards that help you configure communications with your ISP and that give you corporate remote-office access. In most cases, all you need to know is the phone

number of your ISP, your user name, and password.

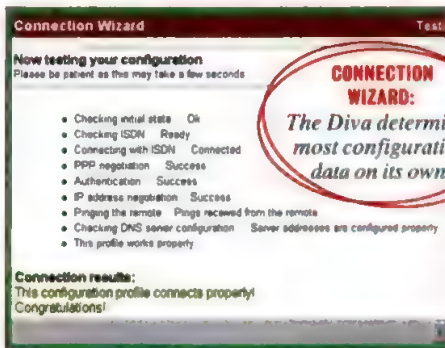
Like most small routers, the Diva uses Name Address Translation (NAT) to share a single-user, single IP address ISP account with up to 50 users on the LAN. The Diva can also act as a DHCP server, so it can automatically assign IP addresses to all the computers

on your local area network.

Performance was excellent. Our test ISP supports Stac compression, so the Diva was able to reach speeds of about 480 Kbps when trans-

ferring compressible text files.

Once the Diva is up and running, you can monitor the unit's activity or change its configuration from any browser on the LAN. Password protection keeps snoopers from messing with the Diva's settings, and the push of a rear-panel button resets the unit. **Diva LAN ISDN Modem.** List price: \$495. Eicon Technology Corp., Montreal; 800-803-4266 (U.S.) or 800-711-9800 (Canada); [www.eicon.com](http://www.eicon.com); 900 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).



## CD Access for Everyone

*Microtest significantly upgrades its CD-sharing technology, as well as its newest DiscportVT.*

By Craig Ellison

Microtest has refreshed its Disc-Zerver line of products with a new release of software and added functional-

via external SCSI devices attached to the unit.

Many things about the DiscportVT have remained the same, including the easy installation and configuration, the Fast

Ethernet port for connecting to your network, the external SCSI connector for quick access to external devices, and the basic Disc-Zerver thin server technology that allows CD-ROM and DVD sharing.

Native Apple Filing Protocol (AFP) support extends CD-ROM sharing to your Macintosh clients. With the previous version, Macintosh clients could access the DiscportVT only via a Web browser or FTP client. The new version lets Macintosh users read Hierarchical File System (HFS), ISO9660, and HFS/ISO hybrid images directly from the DiscportVT. You can choose to make each image a separate mountable volume, or you can have CD images appear as folders under a single mounted volume. HFS CDs can be read directly from a CD-ROM drive attached to the DiscportVT or from an image created from the attached drive.

**DiscportVT.** List price: For 4GB 7-CD version, \$1,995; for 8GB 14-CD version, \$2,495; for 16GB 28-CD version, \$2,995. Microtest Inc., Phoenix; 602-952-6400; [www.microtest.com](http://www.microtest.com); 901 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).



ty. Of the new line, the second-generation DiscportVT stands out. We took a peek at the 16GB, 28-CD version of the DiscportVT (\$2,995 list). This network-attached device enables platform-independent sharing of CD-ROMs and DVDs. CD-ROM images can be cached either on the internal hard disk or accessed directly

The most significant new feature is recording capability. With a CD-recorder attached to the SCSI port, you can record CDs directly from the DiscportVT. Access to the recorder function can be assigned to individual users or groups using a browser-based administration tool. In addition, the DiscportVT adminis-



## Slick Server Solutions

*Server appliances can make your small network more reliable, cost-effective, and user-friendly.*

By Greg Ahwang

**M**any think about networking their small business but shudder at the thought of complicated hardware setup and network operating system installation. But now, there's a new breed of server to come in and save the day. Server appliances, or *microservers*, are designed to eliminate the complexities of networking while still providing basic services. The latest batch of microservers is easier to administer and offers excellent Internet connectivity options as well.

We took a look at three of the latest: the Cobalt Qube 2 (\$1,499 list), the Corel Computer NetWinder Group Server (\$1,839 list), and the Wind-Dance Breeze Network Server (\$3,300 list). All are designed for small- to medium-size businesses that need e-mail, cross-platform file sharing, an intranet server, and an Internet gateway. The Qube and the NetWinder add workgroup extras such as threaded discussions and document management; the Breeze offers printer sharing and faxing capabilities.

Each server runs on either Linux or Net BSD, requiring far fewer resources than Windows NT or NetWare to run effectively. In addition, they include the Apache Web server, which makes them ideal intranet servers or Internet gateways. The Breeze and Qube also support Network Address Translation (NAT), so they both use one real IP address for Internet access and mask your workgroup's individual addresses.

With all three, setup is as close to plug-and-play as you can get and takes under 30 minutes. These server appli-

ances showcase the reliability of the Unix platform and shield end users from its complexity.

### COBALT QUBE 2

Fittingly housed in a 7-inch square cobalt-blue case, the Cobalt Qube 2 looks like it runs on dilithium crystals. And with the mix of features and power squeezed into this little box, you'd think it does. At \$1,499 (list), our test unit came with a 250-MHz RISC processor, 32MB of RAM, and a 5.9GB hard disk running Linux and Apache. (The base model is \$999

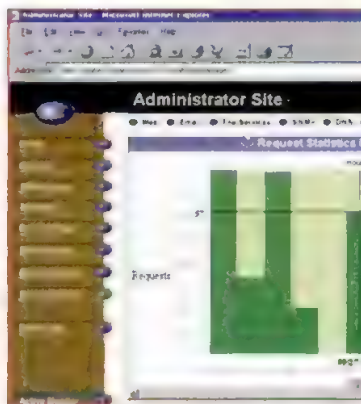
services such as e-mail, FTP, DNS, or file sharing. This all takes about 10 minutes, and then you move on to adding users and groups.

When using the browser interface, an Active Assist feature provides helpful pop-up tips for most features, making setup more user-friendly for newly crowned system administrators. We connected the Qube to a cable modem, entered addresses assigned by our ISP, and we were sharing an Internet connection on our LAN in minutes. This sounds simple—and it is.

Each new user gets an

### ADMINISTRATIVE STRENGTH:

*With the Qube, you can control and configure even complex settings with a browser.*





that with the Qube, but the NetWinder does not support groups. When you log on, a list of users provides links to send e-mail or view each user's customizable home page. An integrated Web Page Creator similar to that on the Qube lets users change their default home pages by adding text, links, and images.

Unlike the Qube and Breeze, the NetWinder lets each user set his or her own e-mail forwarding and filtering rules at the server. The unit supports robust public and private threaded discussions, and unlike the Qube, users can add new forums. A Boolean search option finds words or phrases in any text or HTML files on the server and rates the results. The same Web-based InfoPlace application used on the Qube lets NetWinder users organize documents and links.

There are many uses for the NetWinder as both a departmental server or standalone Linux computer. Its portability makes the NetWinder an excellent choice as a demo platform for developers creating Web-based applications using CGI or Perl. As an Internet gateway, it supports connections only through the second Ethernet port, though you can configure a modem as a gateway through the Linux command line.

**Corel NetWinder Group Server.** List price: \$1,839, with 32MB of RAM and a 6GB hard disk. Corel Computer (a division of Corel Corp.), Ottawa; 613-788-6000; [www.corelcomputer.com](http://www.corelcomputer.com); 904 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

## WINDDANCE BREEZE

### NETWORK SERVER

From WindDance Network Corp., the WindDance Breeze Network Server takes a broader brush approach than the Qube and the NetWinder and targets primarily small businesses that need networking capabilities such as printing and faxing, along with Web server features. Designed to support up to 250 users, the Breeze (\$3,300 list) is also the most feature-complete of the three solutions we tested for this minireview.

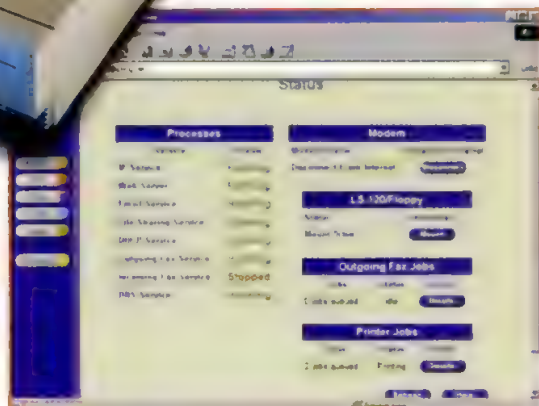
The Breeze runs on a 300-MHz AMD K6 processor with 64MB of RAM and a 17GB hard disk. It was the only unit we tested with an internal V.90 modem and an LS-120 Super-Disk drive for selective backups of critical data. A second

## SPEAK YOUR MIND:

*The NetWinder Group Server supports public and private discussion forums; users can also create their own.*

## WEB CHECK:

*Keep tabs on the status of your network from within the WindDance Breeze Network Server's browser-based interface.*



Fast Ethernet port lets you easily scale Internet connections from 56K dial-up to dedicated, xDSL, or cable modem speeds. Even with dial-up access, the built-in Web proxy cache provides an excellent Internet experience.

The Breeze looks like a PC sans keyboard, mouse and monitor. You connect it to the network and run a setup disk on another workstation, which "brands" the Breeze with IP, domain name, and administrator settings. All the network, server, fax, printer, and Internet connection settings are configured from a browser.

The unit supports DNS and DHCP services, but all DNS settings are handled internally, so the Breeze cannot serve as your systemwide DNS server.

This can be limiting but is sufficient for small workgroups.

To configure a shared printer, you simply activate the printing service and select a printer driver. The device shows up as a shared printer in the Network Neighborhood on workstations. Users create faxes by printing to a special printer, which saves

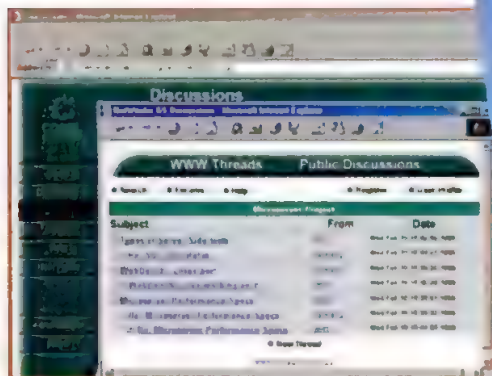
the documents to a holding directory. From the Fax button on the Breeze's Web interface, users fill out a cover page and select the saved document to fax. Faxes are queued and sent whenever the modem is not in use. You can configure the Breeze to print all incoming faxes automatically, or users can preview incoming faxes

online.

The Breeze provides each user with an e-mailbox and a disk space quota, but you can't add users to groups, which can be limiting for larger workgroups requiring more complex access rights. An intranet button in the browser interface links users to a company Web page area where users can post public pages. For workgroups connected to the Internet, the Breeze supports megaPOP configurations where inbound Internet mail can be routed to one mailbox at your ISP and forwarded to each user's mailbox on your server.

The WindDance Breeze Network Server has some rough edges. For instance, we had trouble getting the modem to disconnect consistently, and we experienced additional difficulty with e-mail after changing the domain name during configuration. These minor issues aside, the Breeze provides critical LAN and Web server features in a surprisingly powerful yet easy-to-administer package.

**WindDance Breeze Network Server.** List price: \$3,300, with 64MB of RAM and a 17GB hard disk. WindDance Networks Corp., Ottawa; 613-728-1700; [www.winddance.net](http://www.winddance.net); 903 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink). **PC**



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## Where Are the Good Tunes?

By Patrick Norton

**A**fter our review of the Diamond Rio PMP300 Portable Music Player (see "MP3 Goes Mobile," January 19, 1999), we expected some sort of fallout from the recording industry. The Rio, about the size of a pack of cigarettes, plays back music in the controversial MP3 format (which packs audio of near-CD quality into files one-twelfth the size of typical audio files). MP3-encoded music has a huge following on the Internet where, in the words of one reader, "you can find everything you want."

That mentality in part helped

make the device the subject of a lawsuit. The Recording Industry Association of America (RIAA) sued Diamond, alleging the Rio violated the 1992 Audio Home Recording Act because artists didn't receive royalties for the music played on it. A federal judge denied the RIAA's request for an injunction, and Diamond announced a countersuit in early December.

Most readers didn't find such a cornucopia of available audio. In fact, one of the more common complaints came from readers who had expected tons of their favorite tunes to be free for download on the Web. New ser-

vices—such as Lycos's MP3 Search—comb the Web for MP3-encoded audio, but many links to major-label tunes (and the sites that carry them) are dead.

Sites such as MP3.com, GoodNoise, and Diamond's own RioPort work to offer lawfully distributed tunes, but your response was mixed. One mainstream music seeker, Keisa M., wondered, "Maybe it's just me, but all I saw were MP3 recordings of regular people hoping someone would

download songs they'd done at home." More adventurous music enthusiasts and the many of you who create MP3 files from your own CD collections don't worry so much about online offerings.

Readers who own Rios were enthusiastic about the device's port-

**FREE MP3:** The Diamond Rio Portable Music Player.

ability and battery life, and they appreciated that the Rio doesn't ever skip—not while users are in the gym, jogging, or even skiing.

But even readers who love their Rios lamented the limited storage space available: Rio owners said it delivered 32 minutes of music of reasonable quality. Many of you who had chosen not to buy the Rio echoed the words of Jim Picarello, who wrote, "I will not buy any MP3 device with less than 128MB of memory. Period."

A note to the growing world of portable MP3-playback device manufacturers: People are interested, but deliver more memory.

## Home PC Experiences

By Carol A. Mangis

**O**ur story on home PCs ("Great Home PCs," December 15, 1998) reported that, although prices have dropped and new PCs include many more features, ease of use hasn't improved much.

Among readers, happy pur-

ported that "I decided to buy a Dell Dimension XPS R450 [*PC Magazine's* Editors' Choice] with all the goodies I could afford, and what a difference."

Some, though, are not so happy with their new systems. "I purchased a top-of-the-line Compaq 5660 the week of Christmas, but Santa's helpers must have been on strike. The unit was defective out of the box." This reader decried the vendor's tech support, claiming his system ended up worse than when he'd first received it. Another reader, who was experiencing chronic OS crashes and not-very-



chasers far outnumber those who have experienced problems. But others have decided that upgrading rather than buying a new PC makes more sense, and the technically confident have even built their own systems.

For those who are replacing old systems, the additional speed and great extras of their new PCs are enough reason to have moved up. One reader re-

satisfactory vendor assistance, wished for a more reliable PC.

Some of you preferred to upgrade bare-bones systems rather than buy ready-made PCs. One IT professional reported that he had bought a clone system for less than \$600; he will be updating components as they are introduced. We also heard from readers who have built their own PCs from scratch. The low prices

are attractive, and so is the ability to sculpt exactly the system you want.

If you do build your own PC, expect to spend lots of time, if not money. As a reader says, "One year ago I didn't know the difference between a sound card and a hard disk. This has been the best approach for me. It just required an extensive amount of reading and research."

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**Tell us what you think...**How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of MP3.

**Of course the RIAA should be scared.** Conventional music distribution is archaic and screws both the artist and the consumer. . . . For every Web site that's shut down, there are a thousand FTP sites and trades on IRC. I can't remember the last time I wanted to hear an album and couldn't find it in MP3 in less time than it takes to drive to a record store. If I like the music, I will then go and buy the record, so the artist can get his 10 cents on the dollar.

—Jason

**Music distribution over the Web is the wave of the future,** and once the industry figures out how to price and regulate it, it will become a giant source of profit. MP3 is the first but certainly not the last music format. Music industry efforts should be focused on how to make money from MP3 rather than on closing down illegal sites. Au contraire, they should sit back for awhile, let MP3 gain momentum, then open official sites and make money from them.

—Mannes Naor



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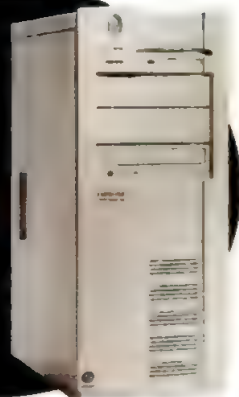
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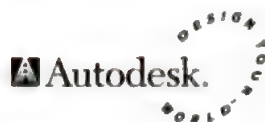
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# Again, the Privacy Bugaboo

Every child dreams of being invisible: the thrill of being there-but-not-there, the ability to sneak into forbidden places and hear secret conversations. Sometimes the dream persists into adulthood. These days, it often evidences itself online. I've just seen presentations from a significant number

of electronic commerce providers. They all sang the same tune: Get to know your customers better, track what they do, and offer them promotions based on their interests, buying habits, and demographics.

The most extreme of these, the recently announced Free-PC.com, gives you a free computer in exchange for the right to advertise—heavily, almost 40 percent of your screen real estate—on your monitor.

Free-PC isn't about consumer-level e-commerce; it's actually about selling an audience to advertisers. If the audience buys, there'll be more free PCs. If it doesn't, there won't. But in every case, the retailers, the market-research firms, or the ad distributors (Free-PC, in this case) improve their aim and with any luck their sell-through by collecting information in the form of surveys, tracking, and sophisticated data mining and analysis.

Privacy advocates have done the proper amount of soul searching about all this data collection and the still unrealized possibility that retailers might start merging their data. They've issued stern warnings, and many online retailers have adopted and published policies stating that they won't sell customer names and will keep transaction histories private.

Still, everywhere you go on the Web, you leave footprints. Your ISP knows the moment you log on. So do the backbone service provider and, of course, the target sites. Not that they care most of the time, but some people are highly annoyed that tracking is even possible. They believe in anonymity at the same level as a cash sale, or that you can walk through any store without having to identify yourself or carry a tag (like a cookie) that says which departments you visited.

Some people also believe that you should be able to post anonymously in chat rooms and newsgroups. They point out that unlike those who hear your casual conversations, the Net has an indelible memory. Everything you've ever said in a newsgroup is there at Deja News. Maybe some of those postings weren't your finest moments, but they're part of the public record now. People may be recording your chat room conversations, then digging back with header

information and cross-correlating with other online resources to learn your full name, where you live, and your credit history. It's harder than dumpster-diving for voided checks, but it's possible. Identity theft is a serious problem and will doubtless grow worse in the near future.

On the other hand, it's well known that some users revert to their worst instincts when they think that their words and deeds are anonymous. Who protects us from their vile excesses and excrescences?

If you'd like to cover your tracks, you can find sites that will mask your identity for a fee, although you can still find some free remailers for mail and newsgroups. You can get more information at [www.epic.org](http://www.epic.org). For private surfing, Anonymizer.com lets you surf anonymously for free but with delayed responses. If you pay an annual fee, you get much faster responses.

A newcomer, Zero-Knowledge Systems ([www.zks.net](http://www.zks.net)), has upped the ante with a client-side product called Freedom, which establishes an encrypted connection to Zero-Knowledge's servers. You pay \$10 per year per encrypted pseudonym, and all the traffic that passes through the ZKS servers is encrypted. ZKS knows who its customers are, but it has no idea what they're doing. Your pseudo-identities are stable, so you can use them for e-commerce, but they can't be correlated back to any other online identity.

Obviously, if you shop online, the retailer still has to ship the goods somewhere, but you can always go through Mail Boxes Etc. if you're truly paranoid. You also have to use a credit card. You could conceivably avoid the credit card by using one of the digital cash schemes, but they've achieved limited acceptance because of high cost, inconvenience, and the non-emergence of an online market for microtransactions.

The battle lines have been drawn. How you characterize the sides depends on your orientation: marketer versus customer, invasive snoop versus freedom-loving citizen, Big Brother versus beleaguered little guy. Whatever your position, the dialectic has begun, and each side is applying the best technology available. **PC**



**Everywhere you go on the Web, you leave footprints. Some people are highly annoyed that tracking is even possible.**

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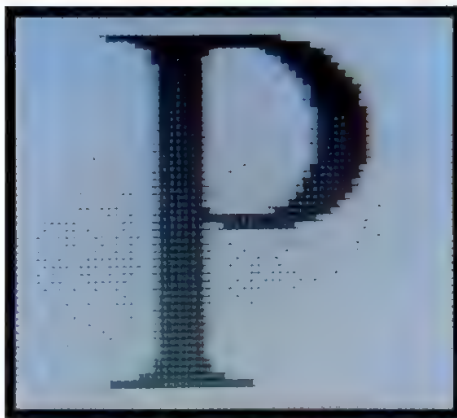
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# What's Going On at Microsoft?

Microsoft stock is sky-high. The company makes more money than ever. Profits are up. But since the first of the year, Microsoft has been planting news stories complaining about its future and about the structure of the company. "Reorganization" is mentioned a lot. Why it would reorganize something so successful is baffling.

I've been trying to read between the lines to determine exactly what's bothering the company. On the surface you'd think it might be the antitrust case, which Microsoft is losing badly because of botched efforts to defend itself. The jury-rigged videotape was probably the worst blunder of all. In case you somehow missed this story, Microsoft made a videotape showing how removing Internet Explorer from Windows would seriously hurt performance. It turned out that the tape was phony, and Microsoft reps finally admitted the tape was a "demo."

Microsoft knows it's going to lose this case, and any reorganization will be designed to decouple various divisions of the company just in case the government asks to break up Microsoft. Rumor has it that the various applications development groups at Microsoft were told to set up surreptitious communications channels within the company that could be kept intact should a breakup of Microsoft actually occur. The legality of this will probably make for yet another government action.

Microsoft's real problem is getting CEO types within the company to head up new divisions. Each has to be willing to run a standalone company. The problem is Microsoft doesn't have any high-end executives left except Steve Ballmer, which is one reason it spent so much effort to get semiretired Brad Silverberg back. The company also hopes Silverberg can save Windows 2000. Microsoft is still saying Windows 2000 is fine and dandy and will be completed and shipping this year. I wonder whether the company is actually in over its head.

With a base of 50 to 60 million lines of code that obviously nobody has a grip on, there has to be an intense feeling of panic within the company. Silverberg, who brought out Windows 95, is seen as a savior, but he must know the reality of the situation too. Many enterprise users who have blindly subscribed to Microsoft's sales pitch can probably limp along with minor updates to Win NT 4.x, but at some point Microsoft is going to have to bring

out what it has kept promising.

Microsoft has already backed off the notion that the Win NT code base of the real Windows 2000 will be used for the consumer replacement of Windows 98. A special version of Windows 2000 using the Windows 95/98 code base will be brought into the market. It may be forever before this old "DOS within" code is replaced on the desktop.

If Windows 2000 is released and turns out to be massively buggy, the company will be in a heap of trouble. I think there is some suspicion that this may be the case. During the period of all this strange press coverage, Gates was quoted admitting it would be next to impossible to keep reinventing the company, and saying he seriously doubts that in 20 years Microsoft will be what it is today. I'm thinking shorter-term than that.

Nobody writing in the popular press wants to predict the emergence of a gentrified Linux as the next major change on the desktop environment or in the Fortune 500. Well, I'm doing so now. The way I see it, Linux's code base is under much tighter control than Windows'.

I've talked to too many ex-Microsoft folk who all tell me that nobody has a handle on Windows' code. It's completely out of control—a hodgepodge of objects and subsystems nobody fully understands. Though this may or may not be true, things are different with Linux. Furthermore, we see more and more companies routinely supporting Linux by adding Linux device drivers to their products.

What's missing from the mix is a genuinely easy-to-use, easy-to-install Linux system exploiting any number of available GUIs. In today's market this means a true plug-and-play Linux. Whether Caldera, Red Hat, or any other newcomer can do this remains to be seen. Microsoft knows the potential is on the horizon. If the company wants to impress me and show its ability to turn on a dime, it should adopt this code itself and embrace and extend Linux as a Win NT replacement. Putting the Windows GUI on top of Linux works for me. It would be a remarkable development.



**If Microsoft wants to impress me, it should adopt Linux as the base code for its future OS.**

## More on the Web:

Read John C. Dvorak's news, views, and snide asides every Monday at PC Magazine Online. And don't miss Dvorak's "Silicon Spin" every day on ZDTV. You can also view past shows at [www.zdvtv.com/siliconspin](http://www.zdvtv.com/siliconspin).

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John Dvorak, *PC Computing*, August, 1997.

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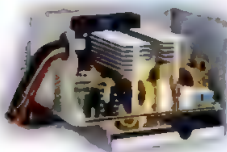
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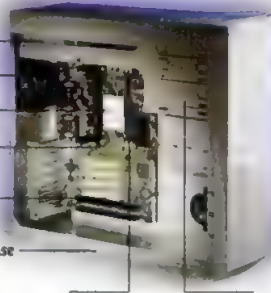
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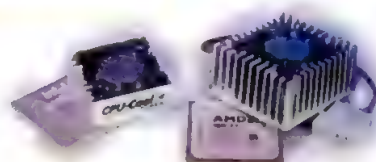
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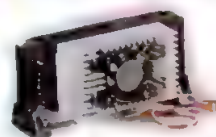
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John C. Dvorak's



# INSIDE TRACK

**Here We Go Again Dept.:** According to some sources, the stolen-computer market has risen to \$8 billion per year. IBM is proposing the use of smart cards to protect machines (mainly laptops). Only the holder of the smart card would be able to unlock the PC. Of course, for this to be effective a lot of "protected" laptops will have to be stolen, so the word gets out that they're useless without the key. This might be more trouble than it's worth, but at least it will introduce the smart card into the market. At first I thought the idea was dubious, then I realized it's actually **part of a grand scheme** to promote the smart card.

**Smart-card technology**, which will inevitably catch on here—if for no reason other than that the whole world is adopting it—has been slow to market in the United States. I was just in France, where I had difficulty using old-fashioned credit cards; everything is done with smart cards. Every restaurant and two-bit street vendor has a hand-held smart-card reader that can **extract money from your card instantly**. U.S. bankers say the main reason smart cards are not in demand here is that the infrastructure for magnetic-stripe cards is so **entrenched**.

Of course, a smart card can have a magnetic stripe, too. When you see the little smart-card readers, you realize that the potential for small cash transactions is huge, and banks should be more aggressive. I believe that banks are **simply waiting** for the technology to pass into the public domain. The smart card was invented in France by Michel Ugon, in cooperation with Motorola, around 1979. Patents (the 17-year variety) were apparently issued into the early 1980s, and the most important ones are now expiring.

The French believe that the United States didn't go with smart cards because the **patent royalties** would have cost banks more than they want to spend. What they want to spend is **zero**. The patents run out in the next year or so. Watch for the **sudden emergence** of smart cards after that.

I believe IBM is using the theft-deterrent argument as **an excuse to position itself for the upcoming smart-card boom**. The company will have millions of machines that are smart-card-ready for small cash transactions over the Net. IBM is aware of the patent expiration, and it works closely with all the major banks. I'm sure the company is doing nothing more than preparation, while other vendors are scratching their collective heads. In fact, IBM was the **lead vendor** in a 1998 smart-card conference held by MasterCard, where it outlined the long-term game plan for deployment.

I've had mixed opinions about whether a smart-card reader will be the next PC peripheral, but I tend to think it will be after seeing the cheap French hand-held readers everywhere. These things sud-

denly emerged in Europe in a **spooky way**, which reminded me of the disappearance of vinyl records almost overnight as everything went to CDs.

IBM will offer a PC Card device, but few desktops have PC Card capability. I suspect that the winner in this category will be a **cheap USB plug-in card reader** selling for \$30 or \$40. I also expect to see **floppy disk adapters** similar to the Olympus device that can read SmartMedia from Olympus cameras. I'm convinced that all small cash transactions over the Internet will be smart-card transactions. **None of the attempts at micropayments** have worked, and one company has already gone broke.

Meanwhile, banks are reluctant to put together a computer mechanism to make it easy to take **sub-\$1 transactions** from regular cards, even though they could accumulate millions of dollars by doing so. Again, this can be rationalized only by a complex marketing scheme to roll out smart cards en masse and use their intrinsic mechanism for small transactions.

Banks do not want to **muddy the water with any alternative schemes**, hence their reluctance to make the Net amenable to micropayments in any other form. If the life cycle of a laptop is optimally 18 months, we must assume IBM's implementation means that **massive smart-card deployment** will take place within 18 months. Get ready. You heard it here first.

**Genuinely Interesting Hardware Dept.:** I got my hands on one of the new solid-ink, full-color, full-duplex Tektronix Phaser 840 printers, and now I can't rave enough about them. Increasing the speed to 10 pages per minute in color and adding 1,200-dpi resolution, this kind of printer should be in every office in the country. Its per-page print cost in color or black and white is **so low** that under any sort of heavy use the printer will end up paying for itself. And the quality of this model with a new **resin-based solid ink** is incredible. Incredible.

I've been a fan of Tektronix printers for years, so my raving is not unexpected. I like the idea that these printers are not just OEM devices scarfed from Canon or Ricoh or who knows where and then renamed. This technology is engineered in Oregon and is unique and fascinating. The printer has an **IP address** and can even **send you e-mail automatically when it needs supplies**. You can also talk to it over a VPN or from a remote Net connection and send it things to print. Also, black ink is free for the life of the printer, an underpublicized benefit. I recommend the Tektronix Phaser 840 Plus (around \$3,200), which prints on both sides of the page. Or the more robust 840 Extended, with a larger paper tray, collation, and other features for the large office. It costs \$4,200. These printers are terrific. **PC**

*We must assume  
IBM's implementa-  
tion means that  
massive smart-card  
deployment will take  
place within 18  
months. Get ready.  
You heard it here first.*





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# Panoramas from Your PC

If the notion of “serious play” at the computer appeals to you, keep reading. If you think computers are strictly business, and play has no place in your world of computing—well, go put together a spreadsheet or something. The rest of us are going to have some fun.

Most of us saw our first panoramic photos in class pictures. A group-picture photographer would come round to schools every year, put up a wide set of bleachers, then hustle school classes and clubs onto those bleachers. His big, clumsy, panoramic camera would slowly rotate left to right, wiping an image of the assembled hordes onto a long piece of film. Smart-ass boys quickly learned that if they sat in the last row of the bleachers at one end, jumped off the second their image was recorded, ran to the other end, and clambered up into the last seats, they could sometimes appear twice in the same photo. I cherish a couple of such photos showing older relatives of mine. (Yes, complete with Uncle Louie doing the smart-ass trick.)

From the first time I saw one of those panoramic photos through thousands more since, I’ve wanted to make panoramas. Not of bleachers full of geeky kids but of the world around me.

Eventually, I bought a couple of big, clumsy, hideously expensive panoramic cameras from Fuji and Linhof, hauled them and the inevitable heavy tripod to a lot of scenic places, and shot thousands of pictures I still like. But though my interest and affection for the genre never ebbed, my available time and my willingness to play pack mule did, and I dropped what had become a cherished form of play for me.

Lately, digital cameras and PC photo-editing software have brought back that sense of play. And judging from the enthusiastic questions of many people who see my electronically produced panoramas these days, I’m far from alone in finding the idea of ad hoc panoramic photos interesting and absorbing.

Today I use a digital camera that’s a fourth of the cost and a tenth of the size and weight of those hefty film-based panoramic cameras, plus some smart software and occasionally a very useful accessory, for my panoramic shots—and I have more fun than I should admit to in public. I like keeping the whole process digital, in large part because most of the magic happens in the digital domain.

Actually, the digital camera is nice, but the smart software is what makes this work. Basically, the soft-

ware stitches together a series of photos, attempting to hide the joins through a series of blending adjustments. The best PC panorama software does this incredibly well—provided you give it reasonable material to work with.

Let’s walk through the process. I’ll pass along tips for the best results.

- Look for scenes that lend themselves to panoramic sweeps. This doesn’t necessarily mean mountaintop vistas; you can make great panoramas from your apartment window or even indoors. But you do want a scene with a wide, horizontal expanse of detail.

- Don’t look for settings where everything you want to see in the final picture is far away. Indeed, giving the picture perspective and scale by including some relatively nearby objects will make it “read” a lot better to others.

- Don’t shoot your panoramas with wide- or superwide-angle lenses. Wide-angle optics make everything seem farther away (just what you *don’t* want), and they aggravate the problem of *hinging*: the sharp angular discontinuities when pictures are joined at their edges to make a horizontal sweep. Use normal or slightly telephoto settings for best results.

- Shoot *lots* of images, not just two or three, as you sweep around. Panorama software produces the best results when you provide 7, 10, or more images for a 120- to 180-degree sweep. If you’re trying to make a 360-degree panorama, shoot at least a dozen images; you’ll be happier with 18 or more.

- Be sure to overlap your images horizontally by at least 50 percent.

- Keep the camera level, and don’t tilt uphill or downhill as you sweep around. A tripod helps, but if you keep your feet still and slowly rotate from left to right as you make the photos, you can make amazingly good panoramas with a hand-held camera.

- Don’t try to keep people out of your panoramas! A few humans, perhaps some blurred ones, can lend a vitality to photos that sterile landscapes often lack.

With your digital photo series transferred to your PC, boot up one of the several stitching programs



**The digital camera is nice, but the smart software is what makes panoramas work.**

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# SAVE

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**Jim Seymour**

available. My favorite is QuickStitch, from Enroute Imaging. (Distribution is thin: You can buy QuickStitch at [www.enroute.com](http://www.enroute.com) for just \$39.95, or QuickStitch Suite for \$89.95, which adds QuickStitch 360.)

You simply won't believe how good QuickStitch's results are the first time you use the program. It removes the angular discontinuity of the panned image; it blends edges seamlessly. This is serious software despite the \$39.95 price.

Up a substantial notch from QuickStitch in price and sophistication is the new Kodak Professional DC260 Interactive Imaging System, which bundles a slightly modified version of the superb Kodak DC260 digital camera with a custom-designed tripod mount for the camera, PhotoVista software from Live Picture, and a how-to video.

I've written before about the Kodak DC260 camera, one of my "practically perfect" picks for 1998. This special edition adds a panoramic-photo program to its on-board operating-system software, making the snap-move-snap-move sequence easy.

And though I've used other Kaidan panorama heads, the convenience and accuracy of the custom KiWi head in this package exceed anything I've seen before. Precisely calibrated click stops make taking level, accurately overlapped pictures child's play. You don't by any means have to have a special tripod head—nor even a tripod—to take good panoramas. But you'll get better results using one—and for 360-degree images, the Kaidan head is essential.

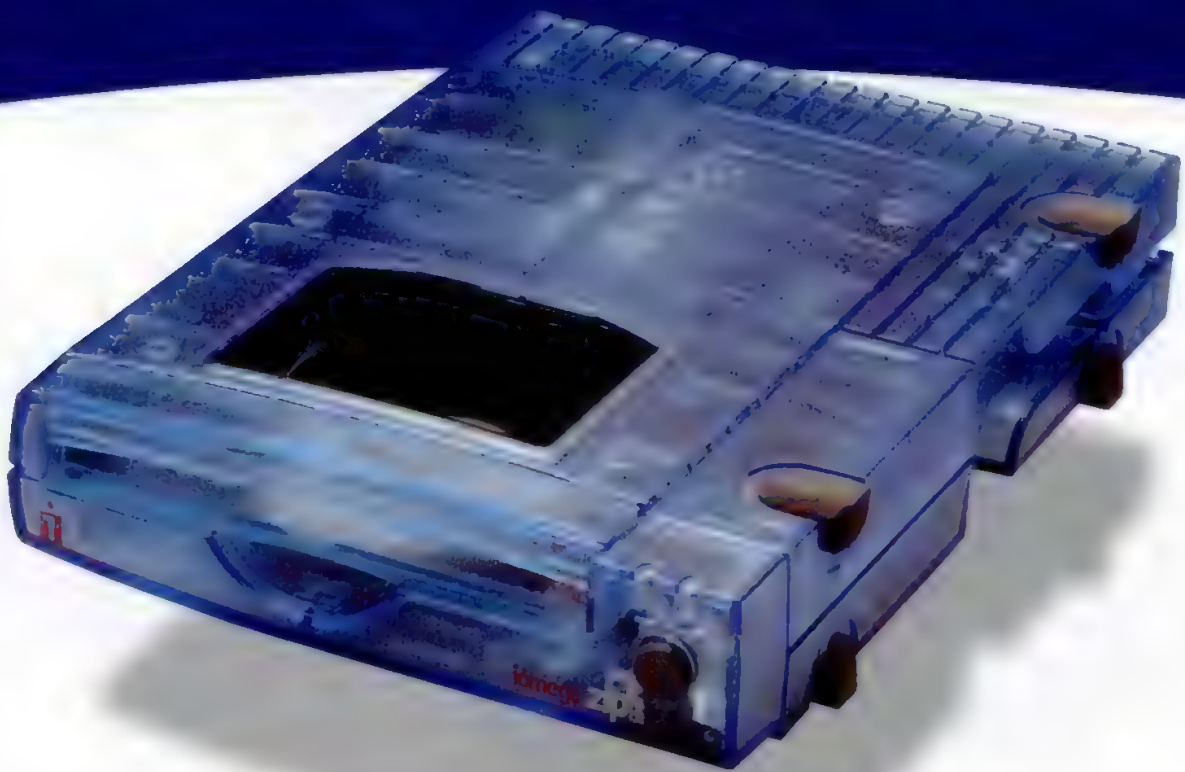
You can buy the complete kit for \$1,599.95 directly from Kaidan ([www.kaidan.com](http://www.kaidan.com)), including a DC260 camera, or just the tripod head and software for \$495.95.

That's expensive—too expensive for someone just getting into taking panoramic photos. I strongly recommend getting the great QuickStitch package for 40 bucks, working with it for a while, then seeing if your interest level and expectations justify a jump up to the Kodak/Kaidan kit.

Let me warn you: Either way, you're going to have a lot of fun. 



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# Scenes from the Industry

Five quick thoughts on the computer world. First: Intel's initial plan to ship the Pentium III with the new **processor ID feature** turned on set privacy-advocate hearts aflutter, proving that about twice a decade Intel screws up royally in misjudging public opinion. The previous occasion was Intel's 1994 claim that the

math bug in the original 60-MHz Pentium CPU wasn't worth worrying about. Intel was right, based on how few people ever swapped out their old chips, but back then, Intel *appeared* to be unconcerned. This time, Intel quickly backpedaled and will ship the CPU with the ID turned off.

Processor IDs have some clear positives: Companies with highly sensitive data (Boeing, say) could restrict remote access only to known computers outside the firewall. Or you could tell Visa to authorize online use of your credit card only when the card number is sent along with a checksum linked to your CPU ID (without sending and disclosing the CPU ID itself).

There's another aspect to processor IDs that few people have considered. Once all CPUs have them, processor IDs could bring back software copy protection. Rather than the clunky 1980s hardware dongle on your printer port or the key disk stuck in your floppy disk drive, with this version of copy protection, the software for program *X* will run only when it's on a computer with a unique CPU ID number *Y*. If that happens, let's hope software vendors allow legitimate exemptions. They're happy selling one copy per user; what they don't like is selling one copy per company. Or per country.

**Free PCs?** One of the software-industry geniuses of the 1980s, Bill Gross (Lotus HAL and Magellan; Knowledge Adventure; now Idea Lab) has been giving away PCs through his start-up, Free-PC.com. To qualify, you fill out a 30-question survey listing your personal habits and your income to the nearest \$10,000 (go to [www.free-pc.com](http://www.free-pc.com)). It's nosy, but it isn't asking anything that credit bureaus don't already know about you. What's troubling is the computer and possibly, for industry insiders, Bill Gross himself. The "free" Compaq PC has loads of gotchas: Half the 4GB hard disk is a cache for ads you see even when you're not online, and 39 percent of the screen is given over to ads that blink, jump, and twirl. It runs at a 1,024-by-768 resolution (you get to use the inner 800-by-600), which is going to be hard on the eyes

with the supplied 15-inch monitor. Industry insiders loved Gross because their kids grew up on his wonderful JumpStart Kindergarten and other titles, but now he's become so—um—commercial.

**Color Palm Devices.** The new displays on the ultra-thin 3Com Palm V (\$450 street) and IIIx (\$370) are dazzling. They're far more legible than those of the Palm I, II, and III. Still, the displays are crisp *monochrome*. More impressive are the color displays coming out on Windows CE palm-held (not Palm brand) devices, because color increases the perceived resolution of small displays. Once the Win CE devices can get through a 12-hour workday, they'll be formidable competitors.

**Pictures on CD, Online.** Photo-finishers, online services, and film makers still want too much money to put your pictures on a disk or CD or to store the images online. Today, for \$5 a month, you can store about 50 low- to medium-res photos online, to share with friends or to order reprints. Or for about \$5 a roll beyond the cost of the prints, you can get your pictures back on a floppy disk (along with prints and negatives) at VGA-level resolution. Want better resolution? For about \$9 a roll, Kodak photo-finishers will put your film on a Picture CD at a good-but-not-great 1,536-by-1,024 resolution with a 24-bit color depth (pro-quality Photo CD goes up to 3,072-by-2,048). Picture CD roughly doubles your processing cost, meaning that when you pick up your film after processing, you've paid \$20 a roll for prints and the CD. I believe the technology will take off when online storage is free, or when transfer to CD (or DVD) is at 3,000 pixels minimum. The transfer costs less than \$5 a roll, *and* the processor keeps unto eternity an archival copy in addition to the one you get.

**Legal Brief.** Wouldn't it have been nice if the Microsoft and Clinton hearings/trial were joined together? And why not? Both were held in Washington, both went on forever, both were hopelessly boring, both had witnesses you could hardly believe, and in both cases Bill probably did something naughty—and will get away with at least some of it. **PC**



**There's another aspect to processor IDs: Once all CPUs have them, processor IDs could bring back software copy protection.**

**More on the Web:**  
What do you think about Intel's processor IDs? Tell Bill Howard online in our *Opinions* section.

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# y2k countdown



**Don't just party like it's 1999.**  
It's already March, and the clock is ticking.  
But there's **still time** to prepare for Y2K.  
Here is what you should know.

**By Jim Seymour**

Illustrations by **Brian Cronin**



So here we are, at nine months and counting to the start of the dreaded year 2000. You've perhaps ignored, disbelieved, or already grown tired of the warnings about the inevitable Y2K problems ahead. But stay tuned a while longer. This is not something "someone else" will fix, and there's still time for you to take preventive measures.

When we reported on "What to Do About the Year 2000" in our issue of October 6, 1998, we focused on recommendations for businesses. That framework stands—minus six months, of course—as a solid reference tool. In this countdown, we're thinking a little more broadly, because the realities of Y2K reach beyond mainframe computers and office PCs. The fact is, there aren't many facets of modern life that are not reliant on some kind of computerized system. That means Y2K has the potential to touch us all, regardless of whether we work or play with computers. Already, 40 percent of big businesses in the U.S. and Europe have suffered minor glitches due to Y2K software problems. And while the federal government has guaranteed that Social Security checks will go out on time, only 61 percent of the government's 6,700 mission-critical computer systems have been repaired, according to the Office of Management and Budget.

In one obvious example (and one that most experts agree on), there will likely be temporary, localized outages of electric power or other utilities, the result possibly of faulty embedded chips that fail when they cannot process the year 2000. The situation would be the same if an ice storm or tornado knocked out power lines—so there's no reason to overreact. If nothing else, then, we all need to keep talking about the realities, so we can all avert irrationality later this year.

So what should you do now? What are your priorities? Will you and your family be prepared? Will your business be okay? In these ten pages, we've put together a Y2K countdown checklist to continue to help you be organized about how you prepare. You may not need to attend to all these areas, and some are out of your control, but consider each. We've hit issues both for business and for the home, and we've organized them loosely from the more general (but still important to be aware of) to the more concrete and personal.



## ten steps to take Now

- 10 Understand the Risks in Embedded Chips**  
*Tiny processors have found their way into everything. Not all will work reliably.*
- 9 Tackle Y2K Problems Locally**  
*Don't wait for the government to take care of them. Here are some ways to get involved.*
- 8 Repair Business Hardware and Software**  
*Despite reports to the contrary, it's not too late to take steps to ensure it'll be business as usual.*
- 7 Get Involved in Infrastructure Issues**  
*Help ensure that the lights and heat stay on and emergency care is available.*
- 6 Look Beyond Your Company's Firewalls**  
*No business is an island, so make sure those you do business with are also prepared.*
- 5 Brace Yourself for the Lawsuits**  
*Here's how to protect your business from the inevitable legal onslaught.*
- 4 Fix Your Home PC**  
*A few simple steps can ensure that your PC and applications are Y2K-ready.*
- 3 Develop Business Contingency Plans**  
*Haven't heard what your employer is doing? It's time to start asking around.*
- 2 Spread the Word on Y2K**  
*Dispel myths about Y2K and make sure your community is taking reasonable measures.*
- 1 Mind the Home Front**  
*Here are a few basic steps to cope with the local problems brought on by Y2K.*

Our Contributors: **Jim Seymour** and **Greg Alwang** are contributing editors, and **Nancy Sirapyan** is the librarian at **PC Magazine**. Executive editor **Gail Shaffer** was in charge of this story.

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The bad news: Many organizations have put off dealing with Y2K for too long and are now discovering there isn't enough time or enough qualified people to fix their Y2K exposure—at least not completely. They're looking at mis-

sion-critical problems and preparing contingency plans. But you still have time to get your PC and your personal affairs and home ready for any serious failures that result from Y2K.

Start now and you'll be fine.

## Embedded Systems



Of all the aspects of the Y2K problem, none is more frustrating—nor more intractable—than that of embedded systems. These chips (properly, *programmable*

*logic controllers*, or PLCs) are all over the world, hidden in many millions of devices that rely on PLCs to keep running.

But one of the great myths of Y2K is that all these PLCs are suddenly going to stop working come January 1, 2000. Not so: A great many of these chips neither know nor care what the date is. Many more use dates only on an internal, relative basis—caring only how many hours, minutes, or seconds have passed since they told some device to do something.

Occasionally, an embedded chip controls the actual, live operation of a device. More often, such chips control only maintenance cycles. But if a device, such as an elevator, cannot operate outside of its scheduled maintenance program, it's likely to stop altogether and not run again until the PLC controlling the frozen function is replaced. If such an error occurs at a power plant, say, or in an emergency room's defibrillator, and interrupts the functioning of an essential part or task, the results can be very serious.

Moreover, with perhaps 25 billion PLCs installed, if even 1 or 2 percent have problems, that's going to mean trouble. (Expert guesses range from 0.1 to 5 percent.) Add to that another frustrating part of the embedded-systems conundrum: They're hard to find. Businesses often have no idea which of their machines are controlled by PLCs—and which PLCs rely on date calculations.

So for businesses, it's a huge problem. For individuals and families, it's a daunting problem, but probably not a critical one. If your refrigerator or freezer relies on a date-sensitive controller, you may get a spontaneous auto-defrost—or no auto-defrost whatsoever—but life will go on.

In general, date calculations are rare in the kinds of PLC-controlled devices most of us have at home. The larger problem for most of us will be the PLC-controlled devices outside our homes: in electric utilities, hospitals, office buildings, toll bridges, commuter railroads (train switches), and so on.

Generally, though, worrying about the embedded-systems

threat is not very productive for most of us. Pressing our public officials and the managers of banks, utilities, health-care networks, and other institutions to work on the problem makes more sense. But frankly, don't expect much progress. This is one deeply embedded Y2K worry that is fiercely resistant to remediation and just won't go away. Many of the noncompliant PLCs will be fixed only after they fail—and in so doing identify themselves.—JS

## Solve Things Locally



We've become accustomed to sitting and waiting for "the government" to fix things. Health-care crisis? The Feds will fix it. Internet privacy? Let Washington handle that one. Y2K crisis? Sounds like a job for Congress.

Except that Y2K doesn't work that way (nor do the other problems, but that's another discussion). Of all the potential Y2K problems that may affect your family or place of business, far more will be solved—or *won't* be solved—through local decisions and local action than in the District of Columbia or even your state capital.

Large businesses, with the resources and the need to resolve Y2K glitches, are tackling their own problems. Small businesses, on the other hand, are lagging as a group. Some lack the resources to throw at this "extra" problem; others simply don't understand that they may be exposed to it, or they may believe that an industry group or the government will intervene to fix things. That's simply not the case.

On the personal level, if the government isn't going to fix Y2K problems for us—and it won't—we've got to tackle the challenges ourselves. Yes, it's late. And yes, the task is daunting. But it's time to get in touch with some of those community-organizing skills you used back in college and just after graduation. Remember the get-out-and-vote campaign? The petition drive to get that dilapidated playground fixed? The campaign for better late-evening bus service? You get the idea.

You could do worse than to start with the excellent *Y2K Citizen's Action Guide*, just published by the celebrated Utne Reader. Founder Eric Utne, who edited the *Guide*, has a wonderfully positive, communitarian perspective: "As we prepare for Y2K, something surprising and quite wonderful is going to happen:





### Lights Out?

*At the current rate, most large U.S. electric power providers should finish up their Y2K remediation and testing efforts sometime around July 1999, based on an October 1998 survey by the North American Electric Reliability Council (NERC).*

|                                   |     |
|-----------------------------------|-----|
| Completed an inventory of systems | 93% |
| Completed Y2K assessment          | 75% |
| Completed remediation and testing | 36% |

Source: "The President's Council on Year 2000 Conversion First Quarterly Summary of Assessment Information," January 7, 1999

We're going to get to know our neighbors." You can read the entire Guide online, free, at [www.utne.com/y2k](http://www.utne.com/y2k), or you can buy a copy for \$4.95 from Amazon.com. The Guide can also be downloaded as an Acrobat (PDF) file.

Throughout 1999, we're likely to see some public confusion and perhaps even moments of panic over the prospect of Y2K problems. You can help by becoming a source of reliable, non-hysterical information. Avoiding manic hoarding, bank runs, and other overreactions is an important goal: Every community will need "citizen leaders" who have developed a reputation for candor and rational thinking.

Working with existing organizations, where possible, may be the best way to get such a reputation. Existing community organizations—PTAs, library and public-television forums, community league groups, business groups, luncheon clubs, and others—already have the structure and credibility you

need to persuade others to act wisely and plan ahead but not go overboard.

You can also lead by setting an example. Don't wait: Talk to local television and newspaper reporters now about their coverage. Indicate that you'll be happy to make yourself available to them for interviews about what you and your friends are doing to plan for Y2K and what others in the community should be doing.

In short, you have to get involved locally. You can rail at Washington all you want, but that won't get anything fixed. And it won't alert you to soft spots you need to plan around to be ready at the local level. Y2K is not *their* problem. It's *our* problem.—JS

## Assess Business Hardware and Software



Y2K will affect your business in many ways, some of which you can control and some of which you cannot. For those you can control—PCs, networking equipment, peripherals, and software—it's not too late to get cracking.

And get cracking you must. Problems with any piece of equipment or software can jeopardize others in your organization.

To tackle the job of assessing Y2K risks to your business systems, follow these basic guidelines:

- Inventory all hardware and applications.
- Assess the business risk (mission-criticality) of those systems.
- Test systems and software for Y2K compliance.
- Determine and prioritize which systems will be fixed or replaced.
- Fix or replace the affected systems, mission-critical first.
- Test, test, test to make sure your fixes worked.

Request Y2K-compliance statements from hardware manu-

educators into how to deal with Y2K problems.

### ► Mitre/ESC Year 2000 Homepage

[www.mitre.org/research/y2k](http://www.mitre.org/research/y2k)  
With information provided by the Air Force Materiel Command and maintained by the nonprofit Mitre Corp., this site contains a complete description of the Y2K problem, including how to take action, details of the five phases of compliance, tips on attaining Y2K certification, lists of solutions and providers and information on contingency planning.

### ► Dr. Ed Yardeni's Economics Network

[www.yardeni.com](http://www.yardeni.com)  
Dr. Ed Yardeni, chief economist of Deutsche Bank Securities in New York and an early herald of Y2K ills, keeps the financial and busi-

ness worlds posted on all facets of Y2K. This site has an enormous amount of timely information in many formats; it considers global ramifications as well.

### ► Michael S. Hyatt's Y2KPrep

[www.y2kprep.com](http://www.y2kprep.com)  
Hosted by author and consumer advocate Michael S. Hyatt, the Y2KPrep site offers advice on how consumers can prepare for the Y2K problem.

### ► Year 2000

[www.house.gov/reform/gmit/y2k/](http://www.house.gov/reform/gmit/y2k/)  
This site contains the Federal Government Year 2000 Progress Reports. These report cards grade major federal agencies on their progress toward solving the Y2K problem. Also available is a report that discusses the Y2K problem at federal, state, and local levels.



### [www.pcmag.com/hotlinks](http://www.pcmag.com/hotlinks)

PC Magazine's Y2K Resource Center is designed to help you assess and fix your Y2K problem. It offers downloadable utilities that will check for Y2K compliance, lists of third-party testing and analysis tools, and links to computing company Y2K policies.

Get fast information on Y2K BIOS- and software-testing tools, plus news and survey results, at [www.zdnet.com/zdy2k](http://www.zdnet.com/zdy2k). This page also carries commentaries, case studies, and links to other resource sites.

### ► Y2K News Magazine

[www.y2knews.com](http://www.y2knews.com)  
The online version of Y2K News Magazine covers everything Y2K. You'll find daily updates of worldwide Y2K news and an extensive archive of Y2K articles, as well as threaded discussion forums and a Y2K chat room.

### ► Year 2000 Information Center

[www.year2000.com](http://www.year2000.com)  
Sponsored by Y2K expert Peter de Jager, this site has links to late-breaking news articles, vendor sites, and user groups, as well as



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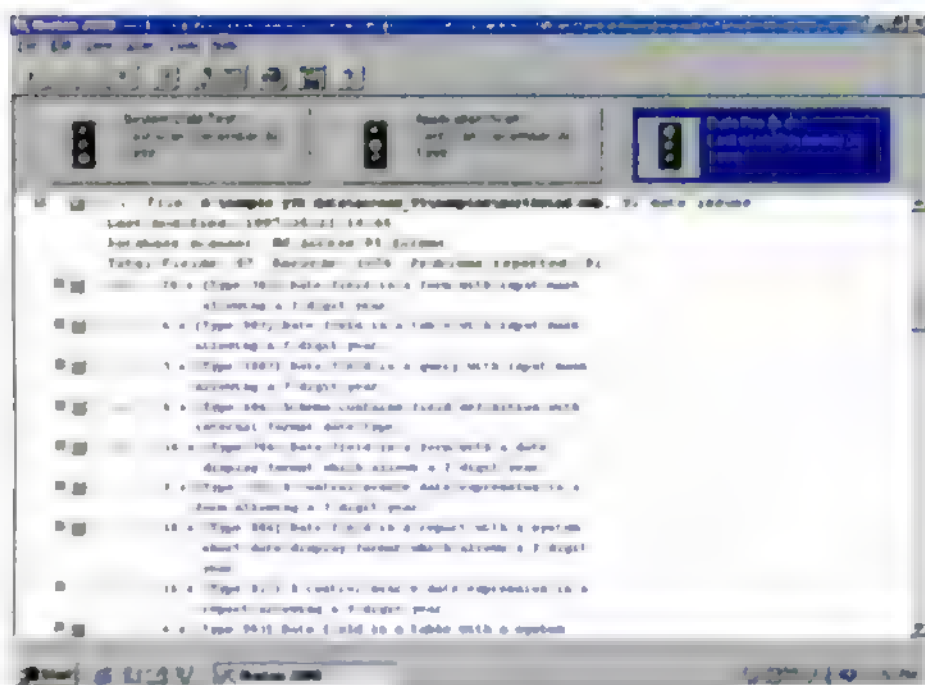
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\*Requires additional software under Windows NT Workstation 4.0. Prices quoted are for U.S. only.

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Norton 2000's sophisticated data file scanner uses five levels of severity to outline potential Y2K issues in databases and spreadsheets—and helps you prioritize fixes.

facturers. Some networking and telecommunications devices may require firmware upgrades or replacement. Test PC BIOSs to see whether they can roll over and support dates after December 31, 1999. Older PCs based on 386 or 486 processors are most at risk. BIOS-testing utilities are available for standalone or networked PCs, and some even provide fixes for noncompliant BIOSs that cannot otherwise be upgraded.

To test PCs, try Yes2K, available free from *PC Magazine's* Y2K Resource Center ([www.pcmag.com/y2k](http://www.pcmag.com/y2k)). Symantec's Norton 2000 has a BIOS Test and Fix—a free download from [www.symantec.com](http://www.symantec.com)—that lets you boot from a floppy disk, test the BIOS, and install a fix program in one easy step. Other BIOS-testing utilities are available from [www.zdnet.com/zdy2k](http://www.zdnet.com/zdy2k).

Finding and assessing the Y2K exposures in software are much more complex. Some software won't support the years after 1999, while other seemingly compliant software can be rendered noncompliant by data or calculations based on two-digit years.

For most off-the-shelf software, you can upgrade to a compliant version, but always check vendor compliance statements. In many cases, vendors stand by compliance claims only if each product is used "as is, out of the box" without any customizations or macros. Below, we survey a few software-assessment products from leading utility vendors.

(For custom software, you may need to contact the developer or a consultant to determine the Y2K status and decide whether to fix or replace a noncompliant application. Your decision will depend on the complexity and age of the system, the developer's availability, the amount of time left before Y2K, and the cost.)

Symantec's **Norton 2000** (\$49.95 list) will not only test your system BIOS and identify noncompliant applications but will also perform sophisticated data-file scanning. Norton 2000 lets you focus your efforts by controlling details of the database- and spreadsheet-scanning engines.

Norton 2000's collapsible reports and color-coded copies of spreadsheets help you tackle Y2K issues; Symantec's **LiveUpdate**

keeps your application-compliance knowledge base up to date. A Corporate Edition (\$75 per user) lets you centrally control Y2K scanning and gather results in an enterprise environment.

Another tool for enterprises is WRQ's **Express 2000 Software Manager** (\$49.50 per seat for 25 seats, [www.wrq.com](http://www.wrq.com)), which helps identify noncompliant software on your client PCs. Express 2000 draws on a comprehensive list of more than 7,200 applications to help you target potential problem apps.

In addition to inventorying and testing BIOSs, Express 2000 meters software use and combines this information with Y2K-compliance data in meaningful reports that help you prioritize your Y2K efforts. It also lets you control or block use of non-compliant applications after they've been discovered.

Once they're identified, repairing Y2K problems in data files is not extremely difficult, but it can be time-consuming with large numbers of files. Network Associates' **McAfee 2000 Toolbox** (\$29.95, [www.nai.com](http://www.nai.com)) identifies Y2K issues in data files and even repairs noncompliant spreadsheet files. 2000 Toolbox is geared for standalone PCs and uses a wizard-driven interface to check your BIOS, applications, and data. It offers no granular control, so you cannot pinpoint specific Y2K issues in your scans. 2000 Toolbox does check for viruses, adding another level of protection.

Many other tools are available for helping you identify, remediate, test, and manage the process of solving Y2K issues in applications and data files. Visit *PC Magazine's* Y2K Resource Center online ([www.pcmag.com/y2k](http://www.pcmag.com/y2k)) for a list. Once you've identified problems and finished your upgrades and fixes, be sure to test systems thoroughly—and then test them again.—Greg Alwang

## Infrastructure Issues

Although no one knows precisely what will happen next January 1, many experts now agree that Y2K-related problems will cause *localized* failures of basic services—utilities, water, and the like—that are broadly

referred to as "infrastructure." Still, it's virtually impossible for anyone to predict where the failures may occur, because of the wild card that is embedded systems.

At home, then, you may be worried about interruptions in your local electric utility service or other utilities, such as water, gas or oil, and telecommunications. (You'll be concerned for your place of business as well, but your company should be asking those questions as part of its general Y2K strategy. See No. 3.)

So, have you called the electric utility serving your area? Virtually every electricity generation and distribution entity in America has set up a de facto Y2K czar—or at least a Y2K information office. Call and ask what's being done, how far along the process is, what remains to be done, how many people are working on the problem, how much has been spent so far, how much remains to be spent. Ask to read a copy of the



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utility's Y2K Emergency Plan. (What? It doesn't have one yet? Kick and scream a little.)

The answers will often be vague, feel-good replies that really mean "Don't worry your little head about this." But even hearing that can be helpful—if it alerts you to a utility that doesn't yet take Y2K problems seriously.

The same goes for other sources you rely on to provide power and heat to your home; remember, this will be the dead of winter, and this past January 1 saw much of the nation in a deep freeze. Some utility companies have begun to notify customers about their preparedness in flyers included with monthly bills right now. Pay attention to them. Some of the notices are non-committal about whether or not service could be interrupted. Press the company for more information.

What about local police and fire service? Call your city or metro-area public safety office and ask about emergency services' Y2K readiness. Don't forget about ambulance service. Call the hospital nearest you, get someone in the administrator's office on the line, and ask what is being done to check emergency room and other critical health-care systems for Y2K compliance.

When you have these answers in hand—even if they're unsatisfactory—start contacting or visiting city officials. Ask what's being done. Tell them about the answers you've gotten. Show up at your next city council or community or school board meeting, get on the list to speak, and ask how the Y2K problem is being handled. Demand a regular monthly

accountability report to the citizens from every affected city department.

Infrastructure issues are key to everything else. It doesn't much matter how computers will cope with the new year if your electricity is off for several weeks, or if your water utility runs into unforeseen problems with embedded systems that need to be located and replaced.—JS

## Outside Connections

Part of your company's Y2K strategy should be checking its outside connections and supply-side vendors. Many businesses have become unalterably interconnected in this Internet world, and data moves across state

and corporate lines, from system to system. As your company secures the Y2K compliance of its own systems, it should insist on compliance in its data dealings with suppliers, distributors, dealers, financial institutions, and yes, even customers. But some of the risk is even more basic than that.

In fact, many businesses have invested a great deal of money and staff time in finding and solving internal Y2K hardware and software problems but haven't paid much attention to their

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In particular, your company should be looking at its supply chain. Not just at the obvious suppliers—companies that provide parts, raw materials, subassemblies—but also at the web of service providers every business relies on: accountants, lawyers, shippers, maintenance and repair outfits, local and long-distance telephone providers, temp agencies, and more.

Look for the hidden problems in internal systems others may overlook. Y2K problems aren't limited to computers, peripherals, and software. Will your company's PBX continue to work properly after January 1, 2000? What about the security system? What about your building's environmental systems?

You should be asking about your company's Y2K contingency plan and trying to become a part of the solution. Perhaps no one has thought through the problems that can be introduced from outside the corporate walls. In the end, you may play an important role in saving your company from big losses—and, perhaps, saving your own job.—JS

## Legal Frenzy

One of the most expensive and longest-lasting aspects of the Y2K crisis will be the legal costs to society. Experts are already estimating the cost of defending Y2K-based actions, including the payment of settlements

and judgments, at more than \$1 trillion. That's a big chunk of our gross domestic product devoted to litigation.

We've already seen suits against IBM, Intuit, Symantec, and other companies for their alleged failure to deliver Y2K-ready products. Many more similar cases will follow. Most of the cases will reflect an ignorance of how computer hardware and software upgrades work—that is, the need to upgrade regularly to later, improved versions. Actually, the plaintiffs in many of these claims may feign ignorance of the usual practices in the computer business. But whether that ignorance is real or calculated may not matter to juries unfamiliar with the industry.

Any way you look at it, we're in for a lot of expensive litigation. Businesses and individuals will sue hardware and software companies. Businesses will sue one another for passing bad data back and forth. Businesses will sue customers for nonpayment of bills that are fundamentally wrong, and customers will sue suppliers for late and mistaken deliveries and those incorrectly filled purchase orders. Businesses that expect their insurance companies to cover any Y2K-related losses will be suing those insurers. And on and on.

You can be a voice for sanity in this by speaking up now. At work, keep urging your managers to tackle internal Y2K prob-

lems immediately. And make sure your company is talking to its suppliers and customers about Y2K issues and about those businesses' own Y2K readiness. This could help avert lawsuits later on.

And encourage candor at your company in its public statements. "Weasel statements" are becoming the norm in Y2K, as companies assure everyone they're doing everything they reasonably can—but of course can't be held responsible for anything they *don't* do. Courts are unlikely to support those disclaimers fully, and they make for bad business anyway. Customers who feel they've been treated forthrightly are much less likely to turn to litigation if things go wrong.

You can also help bring sanity to this situation by acting with restraint yourself and urging others to do so. Not every problem demands a lawsuit. Work with others to find answers, not file pleadings, and we'll get through this more quickly and easily.—JS

## Y2K Compliance on Home PCs

If your home PC is more than a year old or if you use date-sensitive software such as a home finance application, Y2K could have an impact on you. If you use your home PC only for gaming and Internet surfing,

there's little danger that your system will be hurt by Y2K—although your Internet service provider is another matter. Fortunately, testing for Y2K compliance on most PCs is easy and cheap, thanks to a host of shareware and free Y2K utilities for testing and fixing noncompliant systems.



### Passing the Buck

*Even in places where municipalities have developed Y2K-readiness plans, few are actually setting aside the money to ensure those plans are implemented.*

|                                                                         |            |
|-------------------------------------------------------------------------|------------|
| Percentage of local governments in California with Y2K compliance plans | <b>74%</b> |
| Percentage with actual budgets for the Y2K plans                        | <b>4%</b>  |

Source: State of California Department of Information Technology, September 1998 Y2K Survey



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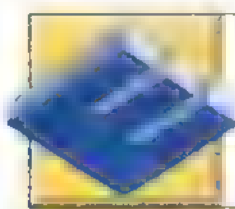
- Inspiron 7000 A366LT – PC Magazine's Editors' Choice for small businesses, 1/99.

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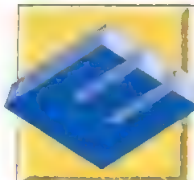


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- ★ MS Windows NT Server 4.0 (10 Client Access Licenses), add \$799

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Business Lease<sup>o</sup>: \$79/Mo., 36 Mos.

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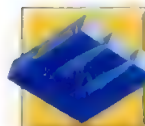
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- MS Windows NT 4.0 and 1-Year NT Telephone Support
- 3-Year NBD On-site\* Service
- 7x24 Dedicated Hardware Tech Support

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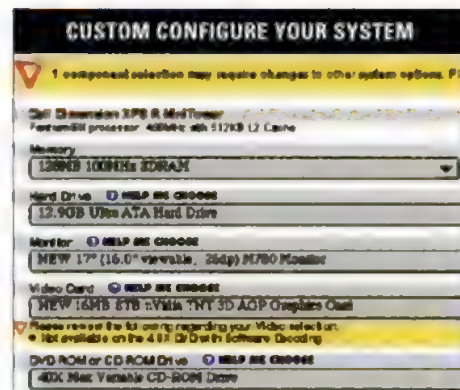
## 2 GO TO THIS



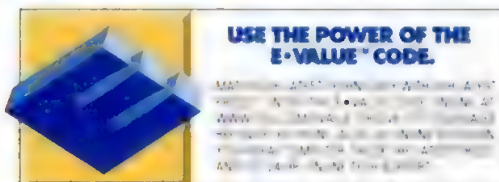
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You'll need to test the PC itself—the operating system, software, and data files. Check with your PC vendor to see if your BIOS is compliant or if an update is required. If a BIOS fix utility is needed, see whether the vendor recommends one. You can find a list of such utilities at [www.pcmag.com/pctech/download/swcol.y2k.html](http://www.pcmag.com/pctech/download/swcol.y2k.html). If you're running Windows 95 or 98, you can use *PC Magazine's* online year 2000 compliance test at <http://cgi.zdnet.com/zdy2k/y2k.pl> to check whether your system's BIOS and clock are compliant.

The easiest fix for noncompliant off-the-shelf software is to upgrade or replace it. If you run Windows 95, 98, or NT 4.0, you'll face minor Y2K issues, such as File Manager's inability to display or correctly sort file dates after 12/31/99 (note that these operating systems by default use the newer Windows Explorer, which does not have this problem). For Win98, Microsoft has released a patch to correct minor Y2K issues. NT users should obtain Service Pack 4 to correct any known Y2K issues. Check [www.microsoft.com/Y2K](http://www.microsoft.com/Y2K) for details.

If you rely on finance, spreadsheet, or database software, carefully check the vendor's compliance statement for your version. You may have a spreadsheet you created in a "compliant" version, but what if you've created macros that act on two-digit years? This type of use is the hardest to detect and can jeopardize the compliance of your spreadsheet.

If you use Intuit's Quicken or Microsoft Money, you're at an even greater risk, especially if you have not always used four-digit dates for years. Fortunately, all versions of Money are deemed compliant by Microsoft ([www.microsoft.com/y2k](http://www.microsoft.com/y2k)), although date windowing or a heuristic algorithm is employed when two-digit dates are used.

Quicken ([www.intuit.com/support/year2000.html](http://www.intuit.com/support/year2000.html)) presents a more complex picture. DOS versions of Quicken before 5.0 do not support years after 1999—you must upgrade to be compliant. Customers using Quicken for Windows 5 or 6 or Quicken 98 release 1, 2, or 3 cannot perform any online banking activities after 12/31/1999. There is a free update for Quicken 98, but updates for earlier versions have not been finalized.

Checking your home PC is relatively easy, and it will give you an appreciation for the massive undertaking being tackled by businesses around the globe.—GA

## Business Contingency Plans

3 Do you know where your company stands on getting ready for Y2K? Have you been involved? Does your company regularly inform employees about its progress on Y2K remediation? Do you know who's in charge of the effort? Does your company even have a Y2K strategy, and does it have a contingency plan as part of that effort?

If you answer no to any of these questions, you may be in trouble.

Sure, every company ought to have a well-planned Y2K



### Assessing the Aftermath

*Though many government agencies have plans to prepare for Y2K, less than a third have plans for coping with the fallout.*

Percent of emergency response organizations with Y2K readiness plans **79%**

Percent with a plan to deal with community problems from Y2K fallout **30%**

Source: A survey of government emergency response agencies by the Emergency Response and Research Institute (ERRI), Chicago

remediation effort under way right now; even better, it should have begun this a year or two ago. But many businesses, especially small businesses, still aren't doing anything about Y2K planning. Among even the largest businesses, with early starts on the problem, progress has been erratic, and the current status of the program may not be widely known.

You can help change that. If you and the other workers at XYZ Corp. haven't heard much about your company's Y2K efforts, start asking. Find out whether the company has designated a de facto Y2K czar, and talk with him or her—this week, for sure.

If there isn't a single person in charge of checking into Y2K exposures, ask that one be named. *Now*. Offer to help. Offer to help get the word out, too. Your coworkers are a great source of tips on possibly hidden Y2K problems, and whoever runs your shop's Y2K remediation needs their help, too.

Business contingency plans are only part of the wider Y2K efforts. Contingency plans are what your company plans to do if systems fail—come January 1, 2000, or whatever other date snags your systems before then.

Small companies may seem to be more at risk, perhaps because they seem less in a position to tolerate any kind of downtime. Yet they're also in a better position to prepare more hands-on approaches for contingency plans. Small businesses are less likely to have big legacy applications that they can't do without. Even those that are just beginning to assess their Y2K risks right now could indeed be able to replace entire PC systems in time.

In many cases, replacement is considered the best solution, but it is out of reach for many medium-size and large businesses that do not have time, given the complexity of their computer dependency. The smallest businesses, on the other hand, can even resort to a paper plan, if need be, at least for a short time. There are trade-offs at all levels of business.



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| Transfer Rate | 5,400        | 5,400        | 5,400        | 5,400        |
| Cache         | 300 Ks       | 200 Ks       | 300 Ks       | 300 Ks       |

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Get involved with your company and find out what you can do. Every business needs some kind of Y2K strategy that includes a sound contingency plan. Your getting involved today could make the difference.—JS

## Help Spread Awareness

Ignorance is bliss. That's the way many people are dealing with Y2K right now. Some people are already sick of hearing about it. The media already seem to have overhyped the subject, and it's only Spring. The danger, of course, is that people will tune out and do nothing. Yes, ignorance is bliss—until "it" sneaks up and bites you where it hurts.

Each person who understands Y2K must be a part of raising awareness about the potential problems—and the ways to manage them rationally—within the reaches of their own social and business circles. This is definitely a situation where an ounce of prevention will be worth a pound (or many pounds) of cure. But each person will have to play a part.

Granted, lost in most of the early media coverage is that much has already been done, and much is under way, across

many public and private sectors. Much is being accomplished on a local basis. Still, much remains to be done. Indeed, the danger of hearing about what has been accomplished is that people may be lulled into a false sense of security: "I don't need to worry. Others are taking care of this." Don't assume that is the case.

Last October, the U.S. Senate passed the Year 2000 Disclosure Act, designed in part "to encourage the disclosure and exchange of information" in dealing with the Y2K problem. Though the press has painted a pretty grim picture of Y2K, this sharing of information and methodologies has served as a catalyst to Y2K compliance efforts in public and private sectors alike.

Many state governments are offering information and seminars to leaders of municipalities, covering how to identify and correct Y2K problems. Following the states' lead, many municipalities across the country have begun to appropriate funds to provide Y2K-specific training and educate citizens on the progress of Y2K compliance. Check with your local organizations to see whether any Y2K-readiness seminars are offered in your area.

For information on the progress of local Y2K compliance, visit your state's Web page. It's usually [www.state.xx.us](http://www.state.xx.us), where xx is your state's abbreviation. For example, [www.state.nc.us](http://www.state.nc.us) takes you to North Carolina's site, where there's a quick link to the state's Year 2000 Project.

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munity organizations, business associations, church groups, school associations, and health clubs. Don't rule out, neighbors, friends, and relatives. Most important, stay tuned to the readiness information in your local community. We're all in this together, and the better informed and prepared we are, the easier the transition will be.—GA

## Home Contingency Plans

Come January 1, 2000, the odds are very good that your basic utilities—power, heat, telephone, and so on—will be working. But some scattered outages and problems seem likely. Just as you should be prepared in case of a natural disaster,

such as an earthquake, hurricane, or ice storm, you should prepare for the threat of this man-made outage. Only this time, you've got plenty of warning. Prepare according to your own sense of what the situation may be like in your area. One thing that is becoming clear is that Y2K-inflicted problems will likely take on a very localized character.

In general, you should prepare for Y2K or any natural disaster in the same ways. Start to set aside extra nonperishable food and water. You should lay aside dried foods and canned goods now, as you have a chance. The incremental extra cost for buying a few extra packages a week now is a lot easier to handle than one big bill this December. Start buying large plastic jugs of water and storing them in a safe place. Or, start laying aside gallon-size milk and juice bottles that you can fill later on. You should have enough on hand for a couple of weeks.

Think about warmth. No matter how mild next winter may be, if you are without normal heat in your home for a couple of weeks, you'll probably need more blankets and warm clothing. This goes even if you have an alternate source of heat, such as a fireplace or wood-burning stove, or even if you have a generator. Do you have a nearby friend or relative with alternate heating? Does your community have a facility designated for such an emergency?

Think about your personal medical needs: Does anyone in your family take insulin? Blood-pressure medicine? Estrogen-replacement drugs? You should have extra supplies of those prescriptions and any other supplies you'll need. Do you have flashlights and extra batteries—and a radio that runs on batteries? Are your security systems and smoke alarms Y2K compliant?

Think about your finances. You should have paper copies of recent bank statements, ATM transactions, securities accounts, social-security statements, and receipts for monthly bills. If your bank's computers are down, it won't be able to supply you with records, but your bills will still come due. You'll have copies ready to send as proof of the status of your accounts. And, as always, you should back up your important computer data files.

Consider keeping a supply of cash on hand—on the chance

## The American Red Cross Y2K Checklist

- ✓ Check with manufacturers of your home electronics to determine what may be affected. Include any device with an embedded chip such as fire and security alarm systems, programmable thermostats, appliances, consumer electronics, garage door openers, electronic locks, and any other electronic equipment.
- ✓ Stock up on disaster supplies lasting from several days to a week. Items to have on hand include nonperishable foods, stored water, and an ample supply of any prescription and nonprescription medications that you regularly use.
- ✓ Have some extra cash on hand in the event that electronic transactions involving ATM cards and credit cards cannot be processed. To avoid long lines at the bank, withdraw cash in small amounts well in advance of December 31 and keep it in a safe place.
- ✓ Fill your vehicle's gas tank a day or so before December 31.
- ✓ In case the power fails, have an alternative cooking device on hand and make sure you know how to use it properly. Never use open flames or charcoal grills indoors.
- ✓ Have extra blankets, coats, hats, and gloves to keep warm. If you do purchase an alternative heating device, make sure it is approved for use indoors and is listed with the Underwriters Laboratories.
- ✓ Have plenty of flashlights and extra batteries on hand. Don't use candles for emergency lighting.
- ✓ Examine your smoke alarms now. If you have smoke alarms that are hard-wired into your home's electrical system (most newer ones are), check to see if they have battery backups.
- ✓ Be prepared to relocate to a shelter for warmth and protection during a prolonged power outage. Have a battery-operated radio or television on hand so you can get information on local emergency shelters.
- ✓ If you plan to use a portable generator, connect what you want to power directly to the generator; do not connect the generator to your home's electrical system. Also, be sure to keep a generator in a well-ventilated area either outside or in a garage with the door open.
- ✓ Check with local emergency services providers for additional information.

*\*For more details, see [www.redcross.org/disaster/safety/y2k.html](http://www.redcross.org/disaster/safety/y2k.html).*

that the financial system is disrupted or stores cannot process credit cards. (Anticipating a larger than usual demand for cash, the Federal Reserve Bank has already begun printing \$50 billion in additional currency.)

All these preparations make sense in general, in case problems arise later this year or after the New Year turns; we should be prepared—not surprised.

There's a huge gap between rational preparations for possible interruptions and survivalist-style bunkering against the end of life as we have known it. Preparation makes sense; anticipating Armageddon does not.—GA and JS 



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*Revolutionary flat-faced CRT Technology* (18" viewable), .25dp
  - ▲ *New* ATI Rage Fury 2X AGP 3D Graphics w/32MB & TV-out
  - ▲ Internal 100MB Zip Drive with one cartridge
  - 56K V.90 PCI Fax/Modem\* w/Voice Mail and Speakerphone
  - ▲ *New* 10MB Ethernet Port, *Cable Modem Ready*
  - ▲ *New* 6X DVD-ROM Drive
  - ▲ *New* Aureal Vortex 2 320-Voice A3D Wavetable Sound
  - Altec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
  - Quantex highly-expandable ATX Mid Tower Case
  - MS Natural Keyboard Elite with MS IntelliMouse
  - MS Windows 98 & Power Bundle
  - MS Office 97 SBE v2.0 (*FREE MS Office 2000 upgrade offer*)
  - 3-year limited warranty with 1-year On-Site Service\*\*
  - ▲ Year 2000 Compliant
  - Add Sony CD-RW Drive for \$299 (24X CD/4X CD-R/2X CD-RW)
  - Upgrade to Quantex 21" Monitor, add \$299

### DESKTOPS FOR HOME AND OFFICE

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- Business lease: \$35/Mo. Order Code #pcm0405**
- Intel® Celeron® Processor 400MHz
  - 64MB SDRAM Memory
  - 128KB Secondary Cache
  - 6.4GB Ultra ATA HD
  - 3.5" 1.44MB Floppy Drive
  - 15" Digital Monitor (13.8" viewable)
  - 64-bit 3D AGP Graphics Accelerator w/4MB
  - 56K V.90 PCI Fax/Modem\* w/Voice Mail and Speakerphone
  - ▲ *New* 40X Max Variable Speed CD-ROM Drive
  - ▲ *New* 128-bit Voice PCI Wavetable 3D Sound & Speakers
  - Quantex highly-expandable ATX Mid Tower Case
  - 104-Key Keyboard with MS Mouse
  - MS Windows 98
  - Corel WordPerfect Office Suite 8 w/Value Bundle
  - 3-year limited warranty with 1-year On-Site Service\*\*
  - ▲ Year 2000 Compliant
  - Upgrade to 17" Digital Monitor (15.8" viewable), add \$79
  - Optional Internal Zip Drive w/one cartridge, add \$79

QP6/366 M-1c(w/Intel Celeron processor 366MHz).....\$949

#### QP6/350 M-2x \$1299

- Business lease: \$48/Mo. Order Code #pcm0406**
- Pentium® II Processor 350MHz
  - 64MB PC100 SDRAM Memory / 512KB Secondary Cache
  - 10GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
  - 17" Digital Monitor w/OSD (15.8" viewable)
  - Toshiba IMPACT2 3D/DVD Media Accelerator w/8MB
  - 56K V.90 PCI Fax/Modem\* w/Voice Mail and Speakerphone
  - 3rd-Generation 4.8X DVD-ROM Drive
  - SoundBlaster AudioPCI Wavetable 3D Sound
  - Altec-Lansing ACS-90 Speakers
  - Quantex highly-expandable ATX Mid Tower Case
  - 104-Key Keyboard with MS Mouse
  - MS Windows 98
  - Corel WordPerfect Office Suite 8 w/Value Bundle
  - 3-year limited warranty with 1-year On-Site Service\*\*
  - ▲ Year 2000 Compliant
  - Upgrade to Altec Lansing ACS-45 1 PowerCube Speakers with Subwoofer, add \$49
  - Optional Internal Zip Drive w/one cartridge, add \$79
- QP6/366 M-2c(w/Intel Celeron processor 366MHz).....\$1199  
QP6/400 M-2w/Pentium II processor 400MHz).....\$1399

#### QP6/500 Best Buy \$1999

- Business lease: \$70/Mo. Order Code #pcm0408**
- ▲ *New* Intel® Pentium® III Processor 500MHz
  - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
  - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
  - 19" Monitor (18.1" viewable), 1600x1200 26dp
  - Intel740 3D 2X AGP Graphics with 8MB SDRAM
  - 56K V.90 PCI Fax/Modem\* w/Voice Mail and Speakerphone
  - 3rd-Generation 4.8X DVD-ROM Drive
  - SoundBlaster AudioPCI Wavetable 3D Sound
  - Altec-Lansing ACS-90 Speakers
  - Quantex highly-expandable ATX Mid Tower Case
  - 104-Key Keyboard with MS Mouse
  - MS Windows 98
  - Corel WordPerfect Office Suite 8 w/Value Bundle
  - 3-year limited warranty with 1-year On-Site Service\*\*
  - ▲ Year 2000 Compliant
  - Optional Internal Zip Drive w/one cartridge, add \$79
  - Upgrade to 30Hz Voodoo Banshee 16MB Graphics, add \$49
  - Add Sony CD-RW Drive for \$299 (24X CD/4X CD-R, 2X CD-RW)
- QP6/450 Best Buy(w/Pentium III processor 450MHz) \$1799

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- Business lease: \$84/Mo. Order Code #pcm0423**
- ▲ *New* Intel® Pentium® III Processor 500MHz
  - 128MB PC100 SDRAM Memory (up to 384MB Max.)
  - 512KB Secondary Cache / Intel 440BX AGPset
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  - ▲ *New* 19" Monitor w/Diamondtron Natural Flat CRT  
*Revolutionary flat-faced CRT Technology* (18" viewable), .25dp
  - *New* 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
  - Based on award-winning Voodoo2 3D Technology
  - 56K V.90 PCI Fax/Modem\* w/Voice Mail and Speakerphone
  - *New* 6x DVD-ROM Drive
  - ▲ *New* Aureal Vortex 2 320-Voice A3D Wavetable Sound
  - Altec-Lansing ACS-45 1 PowerCube Speakers w/subwoofer
  - Quantex highly-expandable ATX Mid Tower Case
  - MS Natural Keyboard Elite with MS IntelliMouse
  - MS Windows 98 & Power Bundle
  - MS Office 97 SBE v2.0 (*FREE MS Office 2000 upgrade offer*)
  - 3-year limited warranty with 1-year On-Site Service\*\*
  - ▲ Year 2000 Compliant
- QP6/450 SM-4x(w/Pentium III processor 450MHz).....\$2199

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  - ▲ **New Ultra-Thin Design (12.44"x9.84"x1.37")**
  - **13.3" XGA Active Matrix Display**
  - **64MB SDRAM / 4GB Ultra-ATA HD**
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  - **24X Modular CD-ROM Drive / 3.5" Modular Floppy Drive**
  - ▲ **New NeoMagic NM65 128-bit AGP Video**
  - **Integrated 16-bit Stereo Sound and Speakers**
  - **Smart Lithium Ion Battery**
  - **USB and Fast IR Ports / Integrated Personal Touchpad**
  - **MS Windows 98 / Corel WordPerfect Office Suite 8**
  - **Quantex Carrying Case - Upgrade to Deluxe Carrying Case for \$89**
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  - **3-year limited warranty on CPU and Main Memory**
  - **1-year parts and labor warranty on all other components**
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- Quantex T-1330 w/Pentium II processor 300MHz...\$1999

#### Quantex T-1400 \$2499

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  - ▲ **New 256K Performance Enhanced On-die cache**
  - ▲ **New Ultra-Thin Design (12.44"x9.84"x1.43")**
  - **14.1" XGA Active Matrix Display**
  - **64MB SDRAM / 6GB Ultra-ATA HD**
  - **56K V.90 Fax/Modem**
  - **24X Modular CD-ROM Drive / 3.5" Modular Floppy Drive**
  - ▲ **New NeoMagic NM65 128-bit AGP Video**
  - **Integrated 16-bit Stereo Sound and Speakers**
  - **Smart Lithium Ion Battery**
  - **USB and Fast IR Ports / Integrated Personal Touchpad**
  - **MS Windows 98 / Corel WordPerfect Office Suite 8**
  - **Quantex Carrying Case - Upgrade to Deluxe Carrying Case for \$89**
  - **Year 2000 Compliant**
  - **3-year limited warranty on CPU and Main Memory**
  - **1-year parts and labor warranty on all other components**
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- Quantex T-1400 w/Pentium II processor 333MHz...\$2299

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#### Quantex I-1510 \$2499

- Business lease: \$87/Mo. Order Code #pcm0460**
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  - ▲ **New 256K Performance Enhanced On-die cache**
  - **15" XGA Active Matrix Display**
  - **64MB SDRAM**
  - **6GB Ultra-ATA HD / 56K V.90 Fax/Modem**
  - **Removable Combo 2X DVD-ROM Drive & 3.5" Floppy Drive**
  - ▲ **New ATI Rage Lt Pro 3D AGP Video w/8MB**
  - **New ESS 3D Wavetable Surround Sound and Speakers**
  - **Long-Lasting 12-Cell Smart Lithium Ion Battery**
  - **USB and Fast IR Ports / Integrated Personal Touchpad**
  - **MS Windows 98**
  - **Corel WordPerfect Office Suite 8**
  - **Quantex Deluxe Carrying Case - Limited time offer!**
  - **Year 2000 Compliant**
  - **3-year limited warranty on CPU and Main Memory**
  - **1-year parts and labor warranty on all other components**
  - **Upgrade from 64MB SDRAM to 128MB SDRAM, add \$149**
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#### Quantex I-1511 \$3299

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- ▲ **New Pentium® II processor 366MHz**
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  - **128MB SDRAM**
  - **New 10GB Ultra-ATA HD**
  - **56K V.90 Fax/Modem**
  - **Removable Combo 2X DVD-ROM Drive & 3.5" Floppy Drive**
  - ▲ **New ATI Rage Lt Pro 3D AGP Video w/8MB**
  - **New ESS 3D Wavetable Surround Sound and Speakers**
  - **Long-Lasting 12-Cell Smart Lithium Ion Battery**
  - **USB and Fast IR Ports / Integrated Personal Touchpad**
  - **MS Windows 98**
  - ▲ **MS Office 97 SBE v2.0 (FREE MS Office 2000 upgrade offer\*)**
  - **Quantex Deluxe Carrying Case - Limited time offer!**
  - **Year 2000 Compliant**
  - **3-year limited warranty on CPU and Main Memory**
  - **1-year parts and labor warranty on all other components**
- Quantex I-1511 w/Pentium II processor 333MHz...\$3099

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cnet Comdex '98 Coverage



#### SLIMLINE PCs

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- Intel740 3D ZK AGP Graphics w/8MB SDRAM
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
- ESS Solo Waveblaster Audio
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- 104-Key Keyboard with MS Mouse
- MS Windows 98
- QSanity Technology (Including Intel LANDesk Client Manager)
- WMI Compliant, DMI 2.0, ACPI
- 3-year limited warranty with 1-year On-Site Service\*\*

#### Quantex VX-400 \$1399

**Order Code #pcm0474**

Above system with Pentium® II processor 400MHz / 128MB SDRAM / 512KB Cache, 10.2GB Ultra-ATA Hard Drive, 17" Digital Monitor (15.8" viewable) and Creative Labs SoundBlaster® 16bit

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- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
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- Intel740 3D ZK AGP Graphics w/8MB SDRAM
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
- Creative Labs SoundBlaster Audio
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- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98
- QSanity Technology (Including Intel LANDesk Client Manager)
- WMI Compliant, DMI 2.0, ACPI
- 3-year limited warranty with 1-year On-Site Service\*\*

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- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- New Quantex 15" LCD Flat-Panel Display
- Intel740 3D ZK AGP Graphics w/8MB SDRAM
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
- Creative Labs SoundBlaster Audio
- New Quantex Slimline Case (12.9"x3.3"x14.2")
- MS Natural Keyboard Elite with MS IntelliMouse
- MS Windows NT 4.0 Workstation
- MS Office 97 SBE v2.0 (FREE MS Office 2000 upgrade offer\*)
- QSanity Technology (Including Intel LANDesk Client Manager)
- WMI Compliant, DMI 2.0, ACPI
- 3-year limited warranty with 1-year On-Site Service\*\*

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Computer Buyers Guide and Handbook (Feb. 99)



#### BUSINESS DESKTOPS

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- Intel® Celeron® Processor 366MHz
- 64MB SDRAM Memory / 512KB Pooled Burst Cache
- 4.3GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Digital Monitor (15.8" viewable)
- 64-bit 3D AGP Graphics Card with 4MB SDRAM
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
- Quantex Highly-expandable ATX Mid Tower Case
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- 3-year limited warranty with 1-year On-Site Service\*\*
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- QSanity Technology (Including Intel LANDesk Client Manager)
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#### QP6/400 SB-2 \$1399

**Order Code #pcm0432**

Above system with Intel Pentium® II processor 400MHz / 6.4GB Ultra-ATA HD and MS Office 97 SBE v2.0 (FREE MS Office 2000 upgrade offer\*)

#### QP6/450 SB-3 \$1699

**Business lease: \$60/Mo. Order Code #pcm0433**

- New Intel® Pentium® III processor 450MHz
- 64MB PC100 SDRAM Memory / 512KB Secondary Cache
- 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 17" Monitor w/OSD & NEC ChromaClear CRT (16.0" viewable), 1600x1200 max resolution, 25dp
- Intel740 3D ZK AGP Graphics w/8MB SDRAM
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
- Quantex Highly-expandable ATX Mid Tower Case
- 104-Key Keyboard with MS IntelliMouse
- MS Windows NT Workstation 4.0
- MS Office 97 SBE v2.0 (FREE MS Office 2000 upgrade offer\*)
- 3-year limited warranty with 1-year On-Site Service\*\*
- 24-hr/7-day Technical Support
- 2 Universal Serial Bus (USB) Ports / DMI 2.0
- QSanity Technology (Including Intel LANDesk Client Manager)
- Cable Modem Ready / Year 2000 Compliant / Windows 2000 Ready

#### QP6/500 SB-4 \$2299

**Business lease: \$80/Mo. Order Code #pcm0434**

- New Intel® Pentium® III processor 500MHz
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- 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- New 18" Monitor w/Diamondtron Natural Flat CRT Revolutionary flat-faced CRT Technology (18" viewable), 25dp
- New Ultra-Fast #9 Revolution IV 128-bit 3D AGP Video w/32MB
- Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
- New 40X Max Variable Speed CD-ROM Drive
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## Digital Video Cameras

## Ready to Roll

By Jan Ozer



**L**ike digital still cameras before them, digital video cameras are gaining in popularity both for business applications (Web video, training videos, multimedia sales and marketing pitches) and home use. Some digital video (DV) cameras are now priced below the magic \$1,000 mark.

Just as important, image quality almost always exceeds that of analog formats such as 8-mm, Hi8, and VHS.

DV cameras fall roughly into three categories: professional-level (typically \$10,000 and up) for news crews and production studios, semi-pro models (\$4,000 to \$6,000) suitable for small television stations or large corporations that shoot a lot of video, and entry-level models (\$1,000 to \$2,500) for business and home users that compete directly with traditional analog camcorders (\$500 to \$1,000). For this story, PC Magazine Labs tested the models in the entry-level class.

For comparison, we included the Hitachi M2 (\$1,500 street), which captures directly to MPEG rather than in DV format. We also included the Canon XL1 (\$4,500) to see how the entry-level units stacked up against a midrange semipro camera. We were not surprised to find that the XL1 bested the lower-priced competition in image quality, though we did find several products that held their own: the Canon Vistara (\$1,000), the JVC GR-DVL9500 (\$1,500), the Sony DCR-PC1 (\$1,500), and the Sony DCR-TRV900 (\$2,100, our Editors' Choice). Sony's new Digital8 (\$900), a crossover model that records digitally to analog Hi8 and 8-mm tape and also plays back analog tapes, was not ready in time for this roundup.

The DV cameras here have a lot in common. Most feature color viewfinders, color LCD panels for preview or play-

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## PRODUCTS SHOWN:

- (1) Sony DCR-PC1. (2) Hitachi M2. (3) Canon XL1. (4) Sharp VL-PD1U Digital SlimCam. (5) Canon ZR. (6) Canon Vistara. (7) Panasonic PV-DG910. (8) Sony DCR-TRV 900. (9) JVC GR-DVL 9500. (10) Canon Optura.



back, image stabilization, special effects (fades, wipes, dissolves), and 10X or higher optical zoom. (Don't be fooled by claimed "digital zoom" power; we found that digital zoom tends to degrade image quality.) Another plus: All of these units can double as digital cameras for still shots.

What's DV's magic? Briefly, DV cameras store video in digital zeros and ones rather than the analog formats used by traditional cameras. Thus, even when the video is compressed into a 5:1 ratio with Motion-JPEG, quality can still exceed that of video caught on tape. And if you plan to edit your videos on the computer for Internet or CD-ROM distribution, the quality benefits are even more striking. That's because with a FireWire card (\$200), you can transfer DV video from camera to computer in native DV format without additional compression or conversion.

By contrast, when editing analog video, you have to digitize and compress the video, adding generations of loss that degrade quality. And whereas traditional analog capture involves a plethora of settings, controls, and adjustments, DV capture entails a simple file transfer between camera and computer. (Plan for lots of disk space, since DV video takes up about 3.6MB per second, or a whopping 210MB per minute.) Once on disk, DV files are stored in AVI (Windows) or QuickTime (Macintosh) format, where they can be edited with programs such as Adobe Premiere or Ulead's MediaStudio and encoded for Internet or CD-ROM distribution.

Even if you just capture for playback on your television set, DV cameras deliver perceptibly better quality than their analog equivalents. Given the shrinking price differential, now's the time to try DV.

**Our Contributors:** JAN OZER, DANIEL GROTTA, and SALLY WIENER GROTTA are contributing editors of *PC Magazine*. S. JAE YANG was the project leader, and senior associate editor JAMIE M. BSALES was in charge of this story.

## Video Quality: You Get What You Pay For

We found that the quality of the video images tracked very closely to the price of the camera. The best images we saw were from the \$4,500 Canon XL1 ①, the poorest from the \$820 Canon ZR ④—with the others, such as the \$2,100 Sony DCR-TRV900 ③, falling somewhere in between. Still, even the lowest-end digital models were able to match the output quality of digitized video from a standard \$800 analog Hi8 camcorder ②.



### Canon ZR, Vistura, Optura, XL1

At \$820 (street), the Canon ZR is among the least expensive digital video cameras in our roundup. It's designed to appeal primarily to families and small businesses that want a low price and small size. If you don't need the very highest-quality images but want to step up from analog to digital video, the ZR is worth a look.

In auto mode, the ZR's images tended to be slightly soft and overexposed compared with the more expensive competition. Indeed, our jury ranked the ZR near the bottom—though still ahead of analog Hi8 video. But the ZR's relative ease of use and modest price tag might interest budget-minded consumers.

Moving up the price scale, the Canon Vistura (\$1,000) is a full-featured, simple-to-operate DV camera that looks, feels, and works as if it were a traditional analog video camera. This unit is a good bet for budget-minded families and business users who want to upgrade from analog to digital—and who want a significant improvement in image

and even rearrange the order of shots; you can also upload or download a video stream from any VCR.

Video images are sharp and bright, aided in part by the accuracy and responsiveness of the auto-focus; even poorly lit scenes were captured well. Our jury preferred the Vistura's images to those of several cameras that cost more, placing it third for our outdoor clips and fourth for indoor captures. The Vistura successfully combines functionality and ease of use with extensive video-editing capability, making it a good choice for nonprofessionals who like to personalize their clips.

The Canon Optura (\$1,300) looks, feels, and shoots like a professional-grade 35-mm single-lens reflex. Its ergonomic design, small size, and fast handling suit it to multimedia artists, photo hobbyists, and professional photographers. But though the zoom and shutter are well placed, there are so many buttons and controls—some hidden under flaps—that new users may initially have difficulty navigating shooting modes and playback options. The Optura has professional-grade fea-



To rate the cameras in **ease of use**, we consider how intuitive each unit is to get up and running. Are the icons easy to comprehend and the menus easy to navigate? We also consider its ergonomics: the feel of the camera in the hand and the placement of buttons for often-used features.

For **video image quality**, we evaluate how the camera's output

|                     | Canon ZR  | Canon Vistura | Canon Optura | Canon XL1 |
|---------------------|-----------|---------------|--------------|-----------|
| Street price        | \$820     | \$1,000       | \$1,300      | \$4,500   |
| Video resolution    | 525 lines | 525 lines     | 525 lines    | 525 lines |
| Ease of use         | Excellent | Good          | Good         | Excellent |
| Video image quality | Fair      | Good          | Good         | Excellent |
| Still image quality | Fair      | Excellent     | Good         | Excellent |



tures such as a "smart" hot shoe for a flash for still images, two focusing modes, an RGB primary filter, and aperture or shutter priority modes. Its progressive-scan charge-coupled device ensures higher-quality stills and better motion-free video frames than the typical interlaced CCD. With progressive scan, virtually every video frame can be used to produce stills.

The Optura's images were among the most noise-free on our Low-Level Image Analysis tests, although our jury ranked its clips slightly below average. Still, it's worth a look for its ergonomics and progressive-scan capture on stills.

We included the Canon XL1 (\$4,500 street) to see how a midrange semiprofessional camera would compare with the entry-level models. Not surprising, its images were gorgeous. The XL1 looks and works as if it were a miniaturized 6.5-pound version of a professional, on-the-shoulder broadcast video camera. This three-CCD unit is perfect for small TV newsrooms and corporate documentary filmmakers who need great image quality.

For speed and convenience, the XL1 has two separate record buttons and an oversize dial for switching between automatic aperture or shutter priority and full manual modes. The zoom is extra-smooth and offers precise speed control. It also displays a warning zebra pattern in the viewfinder to indicate overexposed areas.

Though the XL1 lacks an optical viewfinder and an LCD, its high-resolution 360-degree eyepiece (which can be set for left- or right-eye viewing) is bright and clear. Canon tweaked the XL1's CCDs to boost resolution and sharpness, and its large pixel size (72 microns) means that the DV camera is more sensitive to

## Editors' Choice

### Sony DCR-TRV900



*We found a lot to like in the growing entry-level digital video camera segment. First and foremost, it's worth reiterating that*

even the poorest-performing DV cameras we tested produced better images than a traditional analog Hi8 camera.

Our Editors' Choice is the Sony DCR-TRV900 (\$2,100 street). This feature-packed camera uses a three-CCD system (others in its range use just one) to deliver superior image quality: in this roundup, it was second only to the \$4,500 Canon XL1 professional camera. Controls are well placed and intuitive, and its 3.3-inch LCD can be viewed from any angle, even in bright sunlight. Features that set it apart from the pack include zebra striping on the LCD to warn you of overexposed areas of the frame and a built-in floppy disk drive for saving still digital pictures—much like Sony's award-winning Mavica line of still digital cameras.

Honorable mention goes to the JVC GR-DVL9500 (\$1,500 street). The unit produced excellent image quality on our tests—just a hair behind the pricier Sony. Advanced features—such as in-camera editing, high-speed video capture, and built-in flash for still images—put it ahead of the others in its price range.

Two other models are worth noting: The Canon Vistara (\$1,000), our favorite budget-buy, produced very good images, and the tiny Sony DCR-PC1 (\$1,500) is a fine choice for good image quality and the ultimate in portability.



light while reducing smear (vertical white streaks). The only DV camera reviewed here to have interchangeable lenses, it ships with a 16X optical zoom.

Image quality is clearly superior to that of every other camera in our roundup. Both videos and stills are razor-sharp; colors are accurate without oversaturation; and noise is at an absolute minimum. Good as it is, the XL1 is too big—and too expensive—for casual users. But it's a fine model for professional users who can't spend tens of thousands on a camera. (Canon U.S.A. Inc., Lake Success, NY;

800-652-2666; [www.canondv.com](http://www.canondv.com).)

—Daniel Grotta and Sally Wiener Grotta

## Hitachi M2

If you need to post motion video onto a Web site or into a presentation, you want to do it quickly and easily. Though standard DV cameras deliver pristine images that are easily converted into more compact formats, the conversion itself takes time and disk space. Instead, consider using the Hitachi M2 (\$1,500 street), which captures up to 27 minutes of compact MPEG-1 video for instantaneous Internet posting or local PC playback. Or instead of MPEG-1 video, the M2 can capture up to 3,000 JPEG still images at 704-by-480 resolution. You can play back images on the LCD or on a TV screen via NTSC output. You can also pop the M2's 260MB PC Card hard disk into your laptop for fast transfer.

The M2's MPEG-1 quality is good, as are the still images in JPEG. Though its video quality doesn't approach that of true DV cameras, the M2 is a great product for those seeking the shortest distance between shooting and posting. (Hitachi America Ltd., Brisbane, CA; 800-225-1741; [www.mpegcam.com](http://www.mpegcam.com).)—Jan Ozer

looks in native format, as well as MPEG-2 and VHS formats. Sound quality from the built-in mike is also a consideration.

Since many users may want their video recorders to double as digital cameras, **still image quality** is important. We consider each camera's sharpness and color fidelity when capturing stills. We also consider features specific to still capture, such as accommodation for a flash and whether the camera captures in progressive-scan mode.



| Hitachi M2 | JVC<br>GR-DVL9500 | Panasonic<br>PV-DV910 | Sharp VL-PD1U<br>Digital Slimcam | Sony<br>DCR-PC1 | Sony<br>DCR-TRV900 |
|------------|-------------------|-----------------------|----------------------------------|-----------------|--------------------|
| \$1,500    | \$1,500           | \$1,400               | \$1,300                          | \$1,500         | \$2,100            |
| 352 x 240  | 500 lines         | 400 lines             | 500 lines                        | 500 lines       | 500 lines          |
| Good       | Good              | Good                  | Good                             | Good            | Excellent          |
| Fair       | Excellent         | Fair                  | Poor                             | Good            | Excellent          |
| Fair       | Good              | Good                  | Fair                             | Good            | Excellent          |



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We created a precision-engineered wedge that contains a DVD-ROM, floppy drive, and port replicator connector. With the wedge on, you've got the ultimate, all-in-one multimedia notebook. Snap off the wedge and you've got a lean, mean, 1.2-inch-thick notebook that weighs in at only 5 lbs. (Which is a good thing when you're sprinting for a plane.) Either way, you'll have a notebook with one-touch Internet access, outrageous graphics, a high-speed modem, and a large, vibrant screen. It's everything you could wish for.



#### **PRESARIO 1900-300 INTERNET NOTEBOOK PC**

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64 MB SyncDRAM expandable to 192 MB  
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2nd-Generation DVD-ROM Drive<sup>2</sup>  
256-bit AGP Accelerated 3D Graphics w/2.5 MB VRAM  
56K ITU V.90 Modem<sup>3</sup>  
Smart Lilon Battery  
256 KB Integrated "On-chip" cache  
Microsoft Featured Home Collection  
Microsoft Windows 98

**\$2749**

Port Replicator: Add \$129  
Extra Smart Lilon Battery: Add \$129  
Extra AC Adapter: Add \$49

#### **PRESARIO 1600I-366 INTERNET NOTEBOOK PC**

Intel Pentium II Processor, 366 MHz  
14.1" TFT Active Matrix XGA Display  
96 MB SyncDRAM expandable to 192 MB  
6.4 GB UltraDMA Hard Drive<sup>1</sup>  
24X Max CD-ROM Drive<sup>2</sup>  
256-bit Accelerated 3D Graphics w/2.5 MB VRAM  
56K ITU V.90 Modem<sup>3</sup>  
Smart Lilon Battery  
256 KB Integrated "On-chip" cache  
Microsoft Office 97 Small Business Edition  
Microsoft Windows 98

**\$2999**

192 MB SyncDRAM: Add \$250  
2nd-Generation DVD-ROM Drive<sup>2</sup>: Add \$149  
Port Replicator: Add \$129

#### **PRESARIO 1600I-333 INTERNET NOTEBOOK PC**

Intel Pentium II Processor, 333 MHz  
14.1" TFT Active Matrix XGA Display  
64 MB SyncDRAM expandable to 192 MB  
6.4 GB UltraDMA Hard Drive<sup>1</sup>  
2nd-Generation DVD-ROM Drive<sup>2</sup>  
256-bit Accelerated 3D Graphics w/2.5 MB VRAM  
56K ITU V.90 Modem<sup>3</sup>  
Smart Lilon Battery  
256 KB Integrated "On-chip" cache  
Microsoft Office 97 Small Business Edition  
Microsoft Windows 98

**\$2849**

128 MB SyncDRAM: Add \$200  
Tripp Lite 140 Watt Inverter: Add \$49.95  
Port Replicator: Add \$129

#### **PRESARIO 1600I-300 INTERNET NOTEBOOK PC**

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14.1" TFT Active Matrix XGA Display  
64 MB SyncDRAM expandable to 128 MB  
4.3 GB UltraDMA Hard Drive<sup>1</sup>  
2nd-Generation DVD-ROM Drive<sup>2</sup>  
256-bit Accelerated 3D Graphics w/2.5 MB VRAM  
56K ITU V.90 Modem<sup>3</sup>  
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## JVC GR-DVL9500

The JVC GR-DVL9500 (\$1,500 street) delivers outstanding image quality and a bleeding-edge feature set. Throw in a host of features and you've got a versatile camera that's ideal for a range of consumer, sports videos, and corporate applications.

The GR-DVL9500 offers an intriguing feature set that includes progressive-scan video, still-image recording, and a high-speed, 60-fps capture mode ideal for viewing clips in slow motion. Effects such as wipes, fades, and dissolves are easy to custom configure, and special modes such as sepia, strobe, and black-and-white recording are available during capture or playback. You can assemble up to eight clips with transitions and special effects inside the camera for direct dubbing to VCRs. The unit has six still-image capture modes, including high-speed capture (every 0.7 seconds) and programmable flash.

The JVC GR-DVL9500 posted strong scores on our Low-Level Image Analysis tests, and our jury ranked it second only

to the \$4,500 Canon XL1. This JVC camera is an excellent choice. (JVC Co. of America, Wayne, NJ; 973-315-5000; [www.jvc-america.com](http://www.jvc-america.com).)—JO

## Panasonic PV-DV910

The Panasonic PV-DV910 (\$1,400 street) is an affordable DV camera with an extensive feature set and solidly mid-pack image quality. Throw in a compact, easy-to-handle design and you've got a good choice for consumers seeking to make their first leap into digital video.

Features include three white-balance and five exposure presets, as well as ten special effects including wipe and dissolve transitions and fade-in and fade-out. A handy bookmark function automatically scans to the first blank segment, saving time when you resume shooting after scanning through previous shots.

On our Low-Level Image Analysis tests, the PV-DV910 generally placed in the middle or slightly higher, which is better than several more expensive cameras. Our jury ranked the PV-DV910's images

in the middle of the field—a respectable showing, considering its price. All in all, an impressive performance for this inexpensive crowd pleaser from Panasonic. (Panasonic Consumer Electronics Co., Secaucus, NJ; 800-211-7262; [www.panasonic.com/video](http://www.panasonic.com/video).)—JO

## Sharp VL-PD1U Digital Slimcam

The Sharp VL-PD1U Digital Slimcam (\$1,300 street) performed poorly on our Low-Level Image Analysis tests and jury rankings. Though it was certainly adequate, most buyers would be better off with other cameras. On the plus side, the PD1U's touch-screen 4-inch LCD panel easily lets you specify where to zoom, lock the focus, or make exposure adjustments (a unique feature). It also controls configuration and playback commands, which were fairly intuitive. In other areas, too, the PD1U is relatively feature-rich, with white-balance lock, extensive exposure presets, and a skip-playback feature that lets you cut and paste up to ten discrete segments when dubbing to a video deck or camera.

**A**s expected, the \$4,500 Canon XL1 outclassed the lower-priced competitors. But the Sony DCR-TRV900 was almost as good in low-action scenes ported to MPEG and VHS formats. Most important, our jury declared most of the digital camcorders to be superior to a typical Hi8 analog camcorder.

The jury rankings were conducted in three ways. We shot a busy street scene with fast-moving vehicles with each of the cameras, then asked our jurors to rate the raw quality of the video played straight from the camera through an S-Video port. We also captured an indoor video clip in a typical office environment with each camera and produced an MPEG file and a VHS tape, which were submitted to our jury. The jurors were asked to compare each camera comprehensively with every other one in the roundup.

The Transition-Pixel Ratio tests indicate a camcorder's ability to capture details with accuracy. *Transition pixels* are the pixels that fall at the edge of a line in an image. The resolving power (and imperfections) in the lens determine the amount of blurring that occurs at the edges; the better the lens, the thinner the blurred edge. We report the ratio of the number of transition pixels

differences when the transition-pixel ratio is 10 percent or below. However, the Canon ZR's transition-pixel ratio, which was as high as 16 percent in the vertical direction, was obviously manifested in a fuzzy video image that ranked poorly.

More noticeable to our jurors, however, was the noise in the video. For the Noise tests, we shot a target made of a

neutral gray museum board. The color histogram should show a single gray value, but in the real world other gray values also register, because of the electronic noise introduced inside the camera. We measured the standard deviation of gray levels in the histogram. The Canon XL1's impeccably clean images were pleasing to the eye,

while the Canon ZR's and the Sharp VL-PD1U's speckled video displeased our jurors.—Analysis written by S. Jae Yang

Low scores are best.  
Bold type denotes first place.  
PC denotes Editors' Choice.

|                    | JURY RANKINGS                 |                       |     | LOW-LEVEL IMAGE ANALYSIS |          |                     |           |
|--------------------|-------------------------------|-----------------------|-----|--------------------------|----------|---------------------|-----------|
|                    | Outdoor Clip<br>Digital video | Indoor Clip<br>MPEG-2 | VHS | Transition-Pixel Ratio   |          | Noise (gray levels) |           |
|                    |                               |                       |     | Horizontal               | Vertical | Normal light        | Dim light |
| Canon ZR           | 7                             | 9                     | 10  | 12%                      | 16%      | 2.42                | 3.06      |
| Canon Vistara      | 3                             | 4                     | 4   | 6%                       | 9%       | 1.90                | 1.88      |
| Canon Optura       | 8                             | 7                     | 6   | 7%                       | 10%      | 1.85                | 1.82      |
| Canon XL1          | 1                             | 1                     | 3   | 10%                      | 9%       | 1.38                | 1.19      |
| JVC GR-DVL9500     | 2                             | 6                     | 2   | 7%                       | 8%       | 2.17                | 1.95      |
| Panasonic PV-DV910 | 5                             | 5                     | 8   | 7%                       | 11%      | 2.11                | 2.12      |
| Sharp VL-PD1U      | 10                            | 8                     | 9   | 8%                       | 6%       | 2.84                | 3.26      |
| Sony DCR-PC1       | 4                             | 2                     | 5   | 6%                       | 6%       | 2.55                | 3.49      |
| Sony DCR-TRV900    | 6                             | 2                     | 1   | 8%                       | 8%       | 2.07                | 1.90      |
| Sony Hi8*          | 9                             | N/A                   | 7   | N/A                      | N/A      | N/A                 | N/A       |

The Hitachi M2, which does not capture images in pure digital video format, was reviewed for comparison and not tested.

\* A traditional analog Hi8 video camera, reported for comparison.

N/A—Not applicable: The Sony Hi8's analog technology was not compatible with this test.

to a reference length in the image. As demonstrated by our jury rankings, the human eye is not sensitive to minor

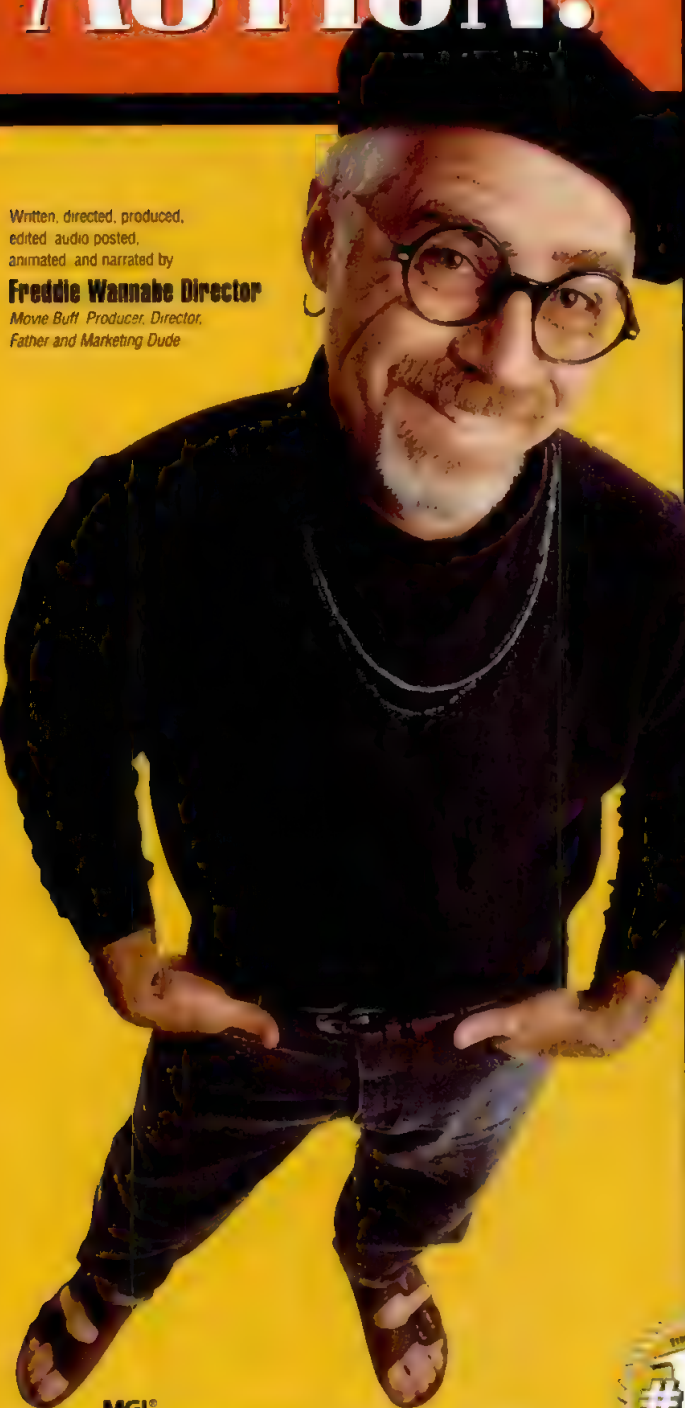


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MGI's other products are just as effective and fun to work with. I've used MGI PhotoSuite II to edit stills for my videos and to create electronic albums of mine and my brother can view my storyboards on the Internet. I also produced an album of our family photos on my computer. The special effects added flair to my photo and red-eye is a thing of the past.



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\*\*SUG. Suggested Retail Price. Dealers may sell for less. \*Video capture device, TV tuner card or DV camera required. ©1999 MGI Software Corp. All rights reserved. MGI, VideoWave, the VideoWave logo and the MGI logo are registered trademarks of MGI Software Corp. All other product names are trademarks or registered trademarks of their respective trademark holders. \*#1 Best Seller based on retail unit sales in the U.S. of Windows-based home video editing software from PC Data Reports, May/December 1997. Priority Code: MW125. MGI's Address: 20000 MGI Way, Suite 100, Redwood City, CA 94063-0001.



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On our Low-Level Image Analysis tests, the PD1U showed more noise than most models we tested. And our jury ranked it at or near the bottom. We also experienced a slight compatibility problem on our FireWire tests, since the PD1U would not respond to single-frame rewind commands—a potential problem with all DV cards having auto-scan capabilities. Though its feature set is admirable, the PD1U doesn't offer the image quality its price would imply. (Sharp Electronics Corp., Mahwah, NJ; 800-237-4277; [www.sharp-usa.com](http://www.sharp-usa.com).)—JO

## Sony DCR-PC1, DCR-TRV900



Sleek, sophisticated, and small enough to slip into a pocket, the Sony DCR-PC1 (\$1,500 street) is a fine choice. Its tiny size, slight weight, solid image quality, and bevy of features make it the digital video camera you'll take everywhere and actually use.

This camcorder takes only seconds to start shooting: Pull the viewfinder out, turn the camera on, point the lens, and press the record button. More advanced

modes or functions may take some memorization, since there are many small buttons with hard-to-read labels.

The unit's image quality is good, as long as lighting conditions are optimal. With too much or too little light, colors become less accurate and details indistinct. Our jury ranked its MPEG-2 format clips second in this roundup and ranked other modes in the middle of the pack. The DCR-PC1 is a marvel of miniaturization. It's one of the best on-the-go DV cameras on the market.

Though larger, heavier, and pricier than most digital video cameras in our roundup,

the Sony DCR-TRV900 (\$2,100 street) delivers virtually everything that demanding semiprofessionals and video artists want. It combines ease of use with excellent image quality.

The DCR-TRV900 automatically generates a warning zebra pattern to mark overexposed areas in the LCD. The most unusual feature is a floppy disk drive; the DCR-TRV900 is the only DV camera capable of saving JPEG still images to a 3.5-inch disk (video is stored to the traditional DV tape).

We were impressed with the DCR-TRV900's image quality. Its progressive-scan three-CCD

system produces sharp, well-defined images while eliminating color aliasing. The zooms were butter-smooth, the autofocus sure and quick. Its images were favorites with our jury.

The DCR-TRV900 is a high-quality camera capable of producing excellent videos and stills. This makes it the digital video camera to beat for demanding users who want the best without going up to a full-blown professional digital video camera. (Sony Electronics Inc., Park Ridge, NJ; 800-222-7669; [www.sony.com](http://www.sony.com).)—DG and SWG PC



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Check out our Web site for great multimedia product coverage and for downloadable files that let you examine our test results for yourself. Also visit these other sites to learn more about digital video technology.

#### ► Desktop Video Home Page

<http://desktopvideo.miningco.com>

Sponsored by The Mining Company, this consumer-oriented guide to digital video includes

links to pages with definitions of industry terms, profiles of people who put the technology to various uses, and instructions on how to shoot digital videotape.

#### ► Video University

[www.videouniversity.com](http://www.videouniversity.com)

This somewhat cluttered site, geared to video hobbyists and pros, includes news, views, and how-tos on a multitude of formats, products, and applications of digital video. There's also a set of community discussion forums.

## SUMMARY OF FEATURES

# Digital Video Cameras



■ YES □ NO

Products listed in review order

|                                    | Canon ZR        | Canon Vistara   | Canon Optura    | Canon XL1         | JVC GR-DVL9500  | Panasonic PV-DV910 | Sharp VL-PD1U Digital Slimcam | Sony DCR-PC1    | Sony DCR-TRV900 |
|------------------------------------|-----------------|-----------------|-----------------|-------------------|-----------------|--------------------|-------------------------------|-----------------|-----------------|
| Street price                       | \$820           | \$1,000         | \$1,300         | \$4,500           | \$1,500         | \$1,400            | \$1,300                       | \$1,500         | \$2,100         |
| Weight                             | 1.2 pounds      | 1.6 pounds      | 2.0 pounds      | 6.5 pounds        | 1.6 pounds      | 1.5 pounds         | 1.5 pounds                    | 0.9 pounds      | 1.9 pounds      |
| Highest video resolution           | 525 lines       | 525 lines       | 525 lines       | 525 lines         | 500 lines       | 400 lines          | 500 lines                     | 500 lines       | 500 lines       |
| Highest still-image resolution     | 640 x 480       | 640 x 480       | 640 x 480       | 640 x 480         | 640 x 480       | 640 x 480          | 640 x 480                     | 640 x 480       | 640 x 480       |
| Size of LCD viewfinder             | 2.5 inches      | 2.8 inches      | 2.0 inches      | 0.7 inches        | 3.8 inches      | 3.0 inches         | 4.0 inches                    | 2.5 inches      | 3.3 inches      |
| Number of pixels                   | 180,000         | 180,000         | 113,000         | 180,000           | 112,000         | 112,000            | 112,320                       | 180,000         | 184,000         |
| Rated battery life                 | 45 minutes      | 60 minutes      | 60 minutes      | 60 minutes        | 65 minutes      | 75 minutes         | 120 minutes                   | 60 minutes      | 120 minutes     |
| High-capacity battery (price/life) | None            | None            | None            | \$220 / 2.5 hours | \$130 / 3 hours | \$200 / 9 hours    | None                          | \$120 / 2 hours | \$150 / 8 hours |
| Number/size of CCDs                | 1 / 0.25 inches | 1 / 0.25 inches | 1 / 0.33 inches | 3 / 0.33 inches   | 1 / 0.33 inches | 1 / 0.25 inches    | 1 / 0.33 inches               | 1 / 0.25 inches | 3 / 0.25 inches |
| Number of live pixels              | 304,000         | 360,000         | 360,000         | 250,000           | 360,000         | 307,200            | 320,000                       | 340,000         | 340,000         |
| Zoom power (optical/digital)       | 11X / 44X       | 16X / 64X       | 14X / 35X       | 16X / 2X          | 10X / 200X      | 18X / 300X         | 10X / 40X                     | 10X / 120X      | 12X / 43X       |
| Accepts optional lenses            | □               | □               | □               | ■                 | ■               | □                  | □                             | ■               | ■               |
| Analog video/audio inputs          | □□              | □□              | □□              | □□                | □□              | ■□                 | □■                            | □□              | ■■              |
| Low light/Sunlight mode            | ■□              | ■□              | ■□              | ■□                | ■□              | ■■                 | ■□                            | ■■              | ■■              |
| Backlight/Auto white balance       | ■■              | ■■              | ■■              | ■■                | □■              | ■■                 | ■■                            | ■■              | ■■              |
| High-speed action or sports mode   | ■               | ■               | ■               | ■                 | ■               | ■                  | □                             | ■               | ■               |
| Overexposure warning               | □               | □               | □               | ■                 | □               | □                  | □                             | □               | ■               |
| Fade/Wipe/Dissolve                 | ■ ■ ■           | ■ ■ ■           | ■ ■ ■           | ■ □ □             | ■ ■ ■           | ■ ■ ■              | ■ ■ ■                         | ■ ■ □           | ■ ■ ■           |
| Solarize/Sepia tone/Mosaic         | ■ ■ ■           | ■ ■ ■           | ■ □ □           | □ □ □             | □ ■ □           | ■ ■ ■              | □ □ □                         | ■ ■ ■           | ■ ■ □           |
| Toll-free technical support        | ■               | ■               | ■               | ■                 | ■               | ■                  | ■                             | ■               | ■               |

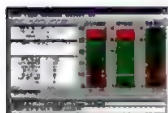


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**Space provided:** 5MB to 12MB.

**Included:** Templates, clip art, wizards, tools; the ability to put chat and discussion forums in your site.

**Extras:** More disk space, domain name registration, search engine submission. Required ads can sometimes be avoided for a fee.

Ample disk space; lots of canned features; wizards; help; additional page features such as chat and Web polls.

Forced advertising or watermarks; limited individuality. Moving a site to another host may require editing out ads or watermarks.

## Web Hosting

**Best for:** Commercial, large-scale sites; data-driven and interactive usage; users who want their own identity and full control.

**Price:** \$15 or more per month.

**Space provided:** Entry level, 5MB to 25MB; can scale up indefinitely.

**Included:** Domain name registration (plus a \$70 one-time fee to InterNIC); authoring software such as FrontPage Express or HotDog; CGI; ASP; templates; FTP access. Provides user activity logging and reporting; the site can be put on a secure server.

**Extras:** Database connectivity for page or data storage; more disk space; multiple domains; anonymous FTP shopping carts; secure transactions; multimedia.

- Scalable, secure, reliable (backup and redundancy); no required ads. You have full control of how your page is displayed.
- Costly. Services differ widely.

## Free Site Premiums

**Best for:** Small businesses and fairly sophisticated personal sites; users who have outgrown free sites.

**Price:** \$4.95 a month and up.

**Space provided:** An additional 5MB to 100MB.

**Included:** CGI, shopping carts, templates, search engine submission.

**Extras:** Domain name registration (plus a \$70 one-time fee to InterNIC); more disk space; e-commerce features.

Ample disk space; inexpensive to upgrade; same content as on free sites; ease of setup. Usually no required ads.

Limited disk space.





# YOUR OWN



The Web is filled with sites designed to host and help you build your Web site—all free. We review seven Web-page hosting sites and six community hosting sites that can get your piece of the Web up and running.



Seems that everybody has a Web page these days. Your bank, your kids, your friends, and your competition have all gotten in on the act. Been thinking about building your own? It may be easier and cheaper than you imagined.

These free-services Web sites have largely taken the place of the low-end software packages designed to let nonprogrammers create Web pages. They've also cut into the number of users who get server space for personal and small-business pages from their ISPs.

The popularity of these sites is staggering. Five of the seven home-page-building services we review consistently rank among the top 15 most trafficked sites each month, according to Media Matrix—and each hosts millions of sites.

Using the templates, wizards, and WYSIWYG tools these sites provide, you can build a simple Web page in minutes. The best sites give you the tools to do more than just the basics, offering advanced features to put on your site, such as chat rooms and your own ad banners.

If group communication features such as message boards and shared calendars and contact lists are more important to you than aesthetics, you might want to check out what is commonly known as a club or a community (see the sidebar "Clubs and Communities"). These sites are more effective for using the Web as a virtual conference room for your

small workgroup or civic club—or as a virtual refrigerator door for your extended family.

Read on to see which sites make it easiest to get a page up today and then a big site tomorrow. Carving out your own corner of the Web is only a few clicks away.

## Angelfire

[www.angelfire.com](http://www.angelfire.com). Free Web space: 5MB. Cost: Pop-up ads or banners. Premiums: None.

● Angelfire has a lot to offer, but putting its elements together in a pleasing way isn't always easy. A beginner can build a good-looking site with graphics and animations superior to those found at GeoCities and Tripod. But be prepared to figure out a few things on your own: Help is meager, and sometimes the forms leave you hanging during even basic tasks. If you want unlimited freedom to move and configure page elements, you're better off at Homestead or GeoCities.

Forms-based wizards in the Basic Editor lead you to Angelfire's free elements but don't necessarily show how to put them on your page. For example, when you go to Angelfire's graphics library, there's no specific instruction on how to import graphics to your page. We found that right-clicking on an image and copying and pasting its location to the form is the correct method.

Angelfire's help and FAQ documentation is sparse. When we e-mailed customer support for help, we received the same unhelpful answer in each instance.

Angelfire's Advanced Editor, a basic

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ILLUSTRATIONS  
BY MELINDA BECK



HTML editor like Notepad, lets you customize the same six templates available with the Basic Editor. The templates—such as a photo album and a list and links page—limit the placement of page elements unless you use Advanced Editor to code everything yourself. You can choose to edit a Basic page in Advanced Editor, but if you do, you can't go back to the Basic Editor.—Carol A. Mangis

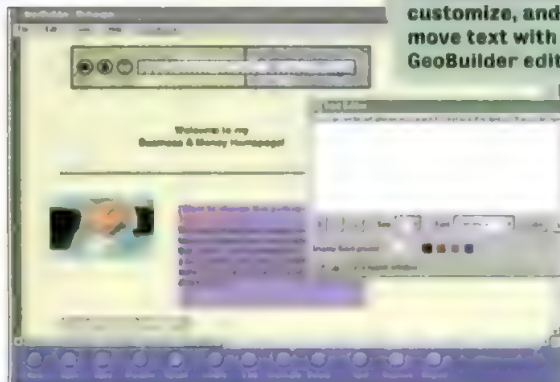
## GeoCities

[www.geocities.com](http://www.geocities.com). Free Web space: 11MB. Cost: Pop-up ads, GeoCities watermark on every page. Premiums: Geo-Plus (no pop-up ads, 14MB extra space), \$4.95 per month; GeoShops (e-commerce solution), \$24.95 per month and up.

● The dashboard of a good car puts all the instruments in logical locations and makes them easy to read and use. GeoCities does the same with its excellent WYSIWYG page-building editor, GeoBuilder. Its features are far better than the forms-based tools offered at Angelfire and Xoom. Only Homestead is comparable in ease of use and flexibility. But, because it offers more interactive features such as Web polling and chat rooms, Homestead has an edge over GeoCities.

The browser-based GeoBuilder is simple to use: Your editing canvas is the main frame, and your tools are in a small frame below. Click on the text tool and a window opens up where you type in the text and select its attributes, such as font and color. Click OK and the text appears on your editing canvas; you can drag it to the desired location on the page. The method for inserting graphics and backgrounds is similar.

It's easy to insert, customize, and move text with the GeoBuilder editor.



**Our Contributors:** ALAN COHEN is a freelance writer. CAROL A. MANGIS is a staff editor. JEREMY A. KAPLAN and SARAH PIKE are copy editors, and ADAM ASCH and RODERICK A. BELTRAN are editorial researchers at *PC Magazine*. JAY MUNRO was the project leader, and staff editor DOUG BEIZER was in charge of this story.

## EDITORS' CHOICE



### • Homestead

*Anyone building a Web site wants the best results with the*

least amount of effort. The site that lets you achieve this is Homestead, and so we award it our Editors' Choice.

Homestead offers the best array of tools and features. For example, its WYSIWYG editor is the best tool for helping a beginner get started, yet it is powerful enough for an advanced user designing a sophisticated Web

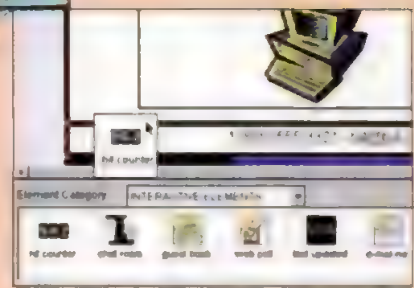
To start, you can use one of GeoBuilder's many page templates—such as Travel or Computers and Technology—but working from a blank screen is just as easy. Free graphics are provided, but they're not as snazzy or sophisticated as those found at Angelfire or Homestead. However, importing your own graphics, via Explorer-like browsing, couldn't be simpler. Once you upload a graphic, it's automatically stored in your account for reuse; you need only click on the graphics tool to access it. You can just as easily import previously created HTML pages, as well as GeoCities add-ons such as a stock ticker. While importing these advanced features at GeoCities is easy, it's easier at

Homestead because many can be dragged into your page.

GeoCities isn't without its annoyances, though. It puts its watermark on every page you create, and there's no way to opt out of having it appear.

—CAM

(PC Magazine's parent company, Ziff-Davis, is an investor in *Deja News*. Softbank, Ziff-Davis's primary



site. It best replicates the experience of using a desktop Web authoring tool to create your site. Where sites with form-based templates restrict your creativity, Homestead instead allows open-ended design possibilities. Homestead also offers special features such as a chat room that you can plug right into your page.

shareholder, is a shareholder of GeoCities and Yahoo!)

## Homestead

[www.homestead.com](http://www.homestead.com). Free Web space: 12MB. Cost: Small link to Homestead on the bottom of every page. Premiums: None.



A Web page created at Homestead won't look like that of any other site in this roundup. Instead of the restrictive forms and templates that Xoom and Tripod offer, Homestead has a powerful WYSIWYG editor that lets you easily make your site as sophisticated as you want without coding—and all with no required ads like those at GeoCities and Tripod. Only GeoCities is on a par with Homestead in its easy-to-use tools and its ability to configure page elements. But Homestead has a slight edge over GeoCities because of the variety of features it offers, such as a chat room or a visitor poll, which you can simply drag into your page.

Homestead's Java-based editor reduces the building process to drag-and-drop simplicity. Much as with GeoCities, you get a blank editing frame with toolbars above and below the main frame. One click and you can drag in a text box, a photo, an animated graphic, or even a chat room. Once an element is on the page, you can drag it to a new location, change its size or color, or replace it. Though Homestead Editor lacks the extensive collection of images found at





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## JOIN US ONLINE

Want to customize your home page? Come to [www.pcmag.com](http://www.pcmag.com) to copy some of our favorite HTML snippets to jazz up your site.

Angelfire, it categorizes hundreds of useful images.

Advanced users have two options for inserting cus-

tom HTML into a page: They can drag an HTML snippet window, which can hold up to 3,000 characters of code, onto the page, or they can drag the imported HTML icon onto the page to pull in an HTML file of any size.

Homestead offers more than 40 templates and a wizard-based editor called Homestead Express, but you are not likely to need either. And if you do use either method, you can easily make the transition to using the regular editor as your site becomes more sophisticated.—*Sarah Pike*

## Hometown AOL

AOL keyword: Hometown, or <http://hometown.aol.com>. Free Web space: 10MB. Cost: Free to AOL members only; banner on every page. Premiums: None.

● Call it the Levittown of the Web: row after row of basic home pages, effortlessly built from the same no-frills parts. But don't be fooled by these "starter

sites." While Hometown AOL may bring quick-and-easy Web pages to the masses, it also provides ample resources for the more ambitious homebuilder. It's more flexible than [theglobe.com](http://theglobe.com)'s or Xoom's rigid editors, but it doesn't offer as much flexibility as either GeoCities or Homestead.

With AOL 4.0's Personal Publisher, a standalone application that integrates with AOL, beginners can design their first page in minutes. There are more than 40 templates to choose from, but that number is deceptive. All contain the same four basic elements—text, links, images, and bulleted lists—which you can add, delete, and move, so that in the end, it doesn't matter which template you choose. At Xoom, for example, you can't add or move template elements.

Not surprising for an AOL product, Personal Publisher emphasizes ease of use. Revisions, for example, are a snap. An on-screen window lists all of the elements on a page. Choose one and make the changes; Personal Publisher displays the result.

But the price of simplicity is—well, simplicity. You can't add guestbooks,

frames, forms, or even counters as you can at GeoCities and Homestead. And though the program lets you choose the order of the elements, Homestead Editor's drag-and-drop interface provides a greater degree of control.

AOL beats the others in its wealth of Web design resources, including tutorials, shareware, classes, message boards, copy-and-paste code—for features such as site navigation buttons and date-last-modified icons—and FAQs.—*Alan Cohen*

## theglobe.com

[www.theglobe.com](http://www.theglobe.com). Free Web space: 12MB. Cost: Pop-up ads. Premiums: Gold (no pop-up ads, 8MB additional space), \$4.95 per month; Platinum (no pop-up ads, 18MB additional space), \$9.95 per month.

● If you are looking for an online community teeming with events, [theglobe.com](http://theglobe.com) is worth visiting. But if you're looking for tools to build a dynamic Web page, stick with the WYSIWYG editor at GeoCities or Homestead. What you get at [theglobe.com](http://theglobe.com) is even more rigid than Tripod's and Xoom's formats.

Theglobe.com's forms-based home page builder is limiting. Its eight tem-



To test free home-page sites and communities, we built sites at each of the services we tested. We tested the tools available to build pages or sites, focusing particularly on how well each site lets you start with a simple page and then grow as your needs expand.

We considered each site's tools in the light of what we had come to expect, having tested Web authoring tools. We evaluated the power and ease of the templates, wizards, and forms that let you build basic pages. This guided approach can be very helpful, but the tools have to be flexible enough that you can build on them for more sophisticated site design.

We also reviewed each site's more advanced site-building offerings. We preferred sites whose Web-based WYSIWYG HTML editors could give you the same power and ease you would expect from a desktop software product.

Administration tools are important if you're going to construct more than just a one-page-template site. We reviewed the file manager metaphor at each site, and we tested the FTP uploading features and any image-importing capabilities.

Additional features such as the ability to plug in a chat room were also considered. And we investigated whether sites offered member services, such as the option of acquiring more disk space.—*Jay Munro*

### EDITOR'S RANKING

| POWER                 | Angelfire | GeoCities | Homestead | Hometown AOL | theglobe.com | Tripod | Xoom.com |
|-----------------------|-----------|-----------|-----------|--------------|--------------|--------|----------|
| Customer support      | Poor      | Excellent | Good      | Excellent    | Good         | Good   | Fair     |
| Guided site design    | Good      | Good      | Good      | Good         | Fair         | Good   | Good     |
| Advanced site design  | Fair      | Excellent | Excellent | Fair         | Fair         | Good   | Poor     |
| Administration        | Excellent | Good      | Good      | Good         | Fair         | Good   | Fair     |
| Member services       | Good      | Good      | Excellent | Excellent    | Poor         | Fair   | Good     |
| Advertising reduction | Good      | Fair      | Excellent | Excellent    | Poor         | Fair   | Fair     |
| EASE OF USE           |           |           |           |              |              |        |          |
| Signing up            | Fair      | Good      | Excellent | N/A          | Good         | Good   | Good     |
| Customer support      | Poor      | Excellent | Good      | Excellent    | Good         | Good   | Fair     |
| Guided site design    | Good      | Excellent | Excellent | Good         | Fair         | Good   | Good     |
| Advanced site design  | Good      | Good      | Good      | Fair         | Fair         | Fair   | Poor     |
| Administration        | Excellent | Good      | Excellent | Good         | Fair         | Good   | Good     |
| Member services       | Good      | Good      | Good      | Excellent    | Poor         | Fair   | Good     |
| Advertising reduction | Good      | Fair      | Excellent | Excellent    | Poor         | Fair   | Fair     |

N/A—Not applicable. This feature is available to AOL members only.

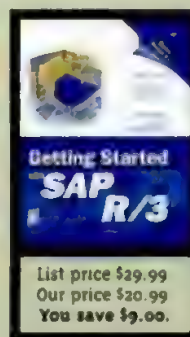
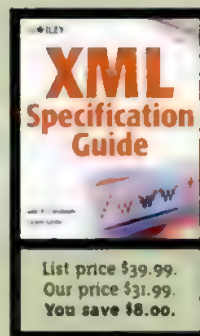
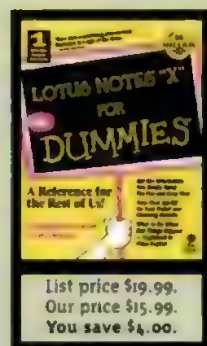




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- USB ports (front and back)

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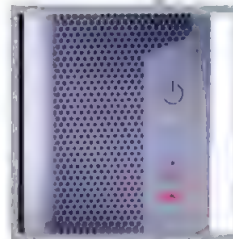
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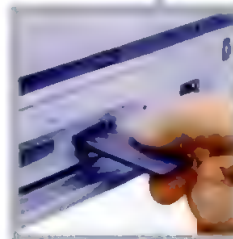
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# Clubs and Communities

A free home page is often all about you, but if it needs to be all about "us," you may want to try a Web community, club, or virtual office space. Focused less on aesthetics and more on ease of use and communications, communities can be up and running in minutes. Standard features include built-in chat rooms, message boards, shared calendars, link lists, and photo albums. Usually you choose whether your site is open to the public or kept private.

**DEJA COMMUNITIES**  
[www.dejanews.com/clist.xp](http://www.dejanews.com/clist.xp)

**Quick take:** Some unique features for business collaboration and intelligence gathering, but Deja Communities is missing some of the basics.

**Pros:** Creating a community also starts a Deja News discussion area. You can follow other Usenet newsgroups from within community. Basic shared text or HTML whiteboard for collaboration. You can custom-choose your URL after [www.dejanews.com](http://www.dejanews.com).  
**Cons:** Community discussion forum is public, even if your community is private. No shared calendar or contact list.



members in a group ensure that everybody knows what's going on at the same time. The only site to let you bulk-invite people to your group. The only site with a personal and a group calendar.

**Cons:** Can't yet store documents in its folders—only URLs and bookmarks to group messages.

**EXCITE COMMUNITIES**  
[www.excite.com/communities/directory](http://www.excite.com/communities/directory)

**Quick take:** With all the standard options (photo book, contact list, discussion forum, shared calendar, and members-only chat rooms), Excite is a solid choice.

**Pros:** Lets you share files, something not found at Yahoo! Clubs. You can customize your welcome page a bit with an image and HTML.

**Cons:** Hard for visitors to find an active public community to join.

**INVOLV.NET**

[www.involv.net](http://www.involv.net)

**Quick take:** Intended to be a virtual office, [involv.net](http://www.involv.net) focuses more on



information dissemination and management than on collaboration.

**Pros:** Professional-looking end product, with many features businesses will appreciate, like the ability to assign tasks to individual users. Polls are easy to set up and provide a good deal of info.

**Cons:** No chat room for team collaboration. Site is graphics-heavy, which makes it slow to download. Difficult to find features without left-hand frame list that most others use. You can't set as many polling features as at eGroups.

**321 WEBSITE**

[www.321website.com](http://www.321website.com)

**Quick take:**

Designed to be a community hub that you point to from your site, 321 Website gives you lots of basic interactivity without much style.

**Pros:** You can get feedback from your visitors with custom-made questionnaires. Uses eGroups for its mailing lists. 10MB free Web space to



For overall functionality, choose Excite Communities. Its file sharing and customizable welcome page beat out Yahoo!'s.

build pages around the calendar, discussion boards, and other features.

**Cons:** Default welcome page is blank. If you want to update the design of your page, the File Manager defaults into an HTML code editor—bad for nontechnies. Clunky browser-based chat room that feels more like a live message board in operation.

**YAHOO! CLUBS**

<http://clubs.yahoo.com>

**Quick take:** Has most of the standard community features, all with the familiar Yahoo! look.

**Pros:** Easy member management, whether removing a member or giving someone management rights. Great picture album that lets users create different albums and post their own pages; it presents much more information than Excite's version.

**Cons:** You can't configure the news section, so you're forced to look at general headlines. No shared-files feature. —Roderick A. Beltran and Jeremy A. Kaplan



**eGROUPS**

[www.egroups.com](http://www.egroups.com)

**Quick take:** A free list server at its core, eGroups facilitates

community by giving you a central place to share.

**Pros:** Group message structure ensures close contact and solidarity among members. Mass mailings to all the

plates, such as Resumé and Photo Album, are more like dictators of page style than starting points for creative page building. The Resumé template, for example, includes standard resumé categories such as experience and skills. But the finished product is laid out confusingly, making it difficult to understand which job you held at which company. By contrast, Homestead's templates are graphical guides that leave the rigidity of forms in the dust, and Xoom's are just laid out better.

Without knowing HTML, you'll have a

hard time adding useful elements to your site. In the Basic template, you add code by typing or pasting it into the blank form provided for both text and HTML code. And bring your own stock images for buttons and bars; with your free account, you can take only ten stock images per year. Only a handful of images are in the free library. The site-building form lets you specify only one image per page—a stock image, an uploaded clip-art image, or an image reference from another Web page.—SP

## Tripod

[www.tripod.com](http://www.tripod.com). Free Web space: 11MB. Cost: Pop-up ads. Premiums: 11MB additional space; e-mail forwarding ([username@tripod.net](mailto:username@tripod.net)), \$18 for 6 months; ad removal for premium members, additional \$3 per month.

● If your Web site plans are simple, Tripod will do the job. But by the time you've whet your appetite to do more, you'll max out its tools and be forced to hand-code HTML. To go beyond a cookie-cutter site, stake your claim at Hometown AOL, or better yet at GeoCities or Homestead,

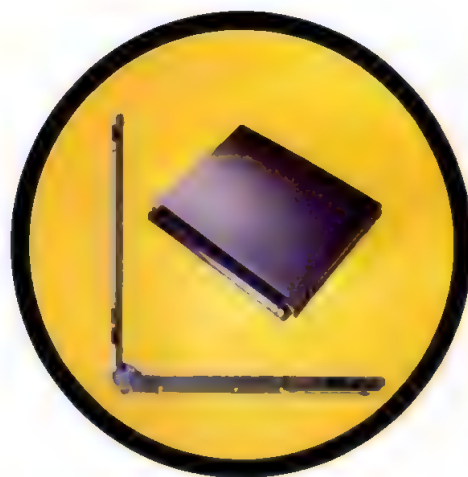


**SONY**



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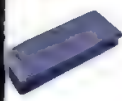


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|                                                                          | 505TS                                                                                                                                                                                                                                                         | \$1,999.99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 505TX                                                                                                                                                                                                                                                         | \$2,499.99                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Even lighter which is 90% sized than one-button on original portable PC? | <b>2,500 FREE frequent flyer miles with purchase</b> (includes United Airlines, American, USAir and Northwest/Continental).<br><br><b>FREE USB Mouse</b> with upgrade, a \$49.99 value<br><br><b>Customize with:</b><br>★ Upgrade to 128 MB RAM add: \$300.00 | <b>As low as \$36.09 a month*</b> <ul style="list-style-type: none"> <li>Intel Pentium processor with MMX technology 300 MHz</li> <li>64 MB SDRAM (expandable to 128 MB)</li> <li>4.3 GB fixed hard drive</li> <li>0.9" thin; 2.7 lbs.</li> <li>10.4" SVGA Active Matrix Display</li> <li>V.90 modem</li> <li>High-capacity Lithium-Ion battery</li> <li>Touch pad with pen operation</li> <li>Bundled port replicator and external floppy disk drive</li> <li>One type II PC Card slot with card bus zoomed video support</li> </ul> | <b>2,500 FREE frequent flyer miles with purchase</b> (includes United Airlines, American, USAir and Northwest/Continental).<br><br><b>FREE USB Mouse</b> with upgrade, a \$49.99 value<br><br><b>Customize with:</b><br>★ Upgrade to 128 MB RAM add: \$300.00 | <b>As low as \$45.12 a month*</b> <ul style="list-style-type: none"> <li>Intel Pentium processor with MMX technology 300 MHz</li> <li>64 MB SDRAM (expandable to 128 MB)</li> <li><b>6.4 GB fixed hard drive</b></li> <li>0.9" thin; 2.7 lbs.</li> <li><b>10.4" XBRITE XGA Active Matrix Display</b></li> <li>V.90 modem</li> <li>High-capacity Lithium-Ion battery</li> <li>Touch pad with pen operation</li> <li>Bundled port replicator and external floppy disk drive</li> <li>One type II PC Card slot with card bus zoomed video support</li> </ul> |

|                                                                             | F190                                                                                                                                                                                                                                                                                                                                  | \$3,299.99 plus \$100.00 rebate                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | F180                                                                                                                                                                                                                                                                                                                                                                                  | \$2,499.99                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ...s. and 1.6" so you'll never before and come el comes pre-ly thing we ans | <b>10 FREE DVD rentals from NetFlix<sup>®</sup> with purchase*</b> (offer expires 5/31/99)<br><br><b>Order a 2nd Lithium-ion battery now and get a \$125 rebate.</b> (Rebate period 2/1/99-4/7/99.)<br><br><b>FREE USB Mouse</b> with upgrade, a \$49.99 value<br><br><b>Customize with:</b><br>★ Upgrade to 128 MB RAM add: \$200.00 | <b>As low as \$59.56 a month*</b> <ul style="list-style-type: none"> <li>Intel Pentium II processor 366 MHz</li> <li>64 MB SDRAM</li> <li>6.4 GB hard drive</li> <li>2X DVD-ROM drive</li> <li>14.1" XGA TFT Display</li> <li>V.90 modem</li> <li>High-capacity Lithium-Ion battery, dual battery capability</li> <li>128-bit graphics acceleration</li> <li>Built-in stereo speakers</li> <li>Digital touch pad</li> <li>Digital video movie editing capability via i.LINK and DV Camcorder</li> </ul> | <b>10 FREE DVD rentals from NetFlix<sup>®</sup> with purchase*</b> (offer expires 5/31/99)<br><br><b>Order a 2nd Lithium-ion battery now and get a \$125 rebate.</b> (Rebate period 2/1/99-4/7/99.)<br><br><b>FREE USB Mouse</b> with upgrade, a \$49.99 value<br><br><b>Customize with:</b><br>★ Upgrade to 128 MB RAM add: \$200.00<br>★ Upgrade to 6.4 GB hard drive add: \$200.00 | <b>As low as \$45.12 a month*</b> <ul style="list-style-type: none"> <li>Intel Pentium II processor 333 MHz</li> <li>64 MB SDRAM</li> <li>4.3 GB hard drive</li> <li>2X DVD-ROM drive</li> <li>14.1" XGA TFT Display</li> <li>V.90 modem</li> <li>High-capacity Lithium-Ion battery, dual battery capability</li> <li>128-bit graphics acceleration</li> <li>Built-in stereo speakers</li> <li>Digital touch pad</li> </ul> |

## 21X ACCESSORIES THE 838 MODULAR NOTEBOOK

-  **External 14X CD-ROM Drive** PCGA-CD5: \$299.99
-  **AC Adapter** PCGA-AC51: \$99.99
- Long-Life Rechargeable Battery Pack** PCGA-BP12: \$249.99
- Standard Rechargeable Battery Pack** PCGA-BP11: \$149.99
- Battery Charger** PCGA-BC1: \$199.99



### Swap any drives and battery to take only what you need.

The new Sony VAIO 838 Notebook is just what every power-hungry office nomad is looking for. More power and portability. Packed with our road-warrior 3MAX<sup>™</sup> features, this notebook offers **MaxMobility** (under 6 lbs. and less than 1.75" thin), **MaxScreen** (a full-color 13.3" high-resolution XGA display) and **MaxBattery** (up to 8 hours of power without a charge). Plus, the DVD-ROM drive, floppy disk drive, second battery<sup>1</sup> or second hard drive<sup>1</sup> are all interchangeable so you take only what you need. All told, it's a mighty powerful PC wrapped in a light and slim package.

#### Pre-installed Software: 3MAX Features:

- Windows 98
- Microsoft Outlook 98
- Microsoft Works
- Adobe PhotoDeluxe
- MaxMobility: Less than 7 lbs.<sup>1</sup>; 1.75" thin
- MaxScreen: 13.3" Active Matrix LCD Display
- MaxBattery: 2X battery life<sup>2A</sup>
- Using optional second battery in floppy drive bay

<sup>1</sup>Optional purchase required

<sup>2A</sup>With weight saver floppy in drive bay.

<sup>2B</sup>With optional second hard drive and removable drive bay. Battery life may vary based on usage

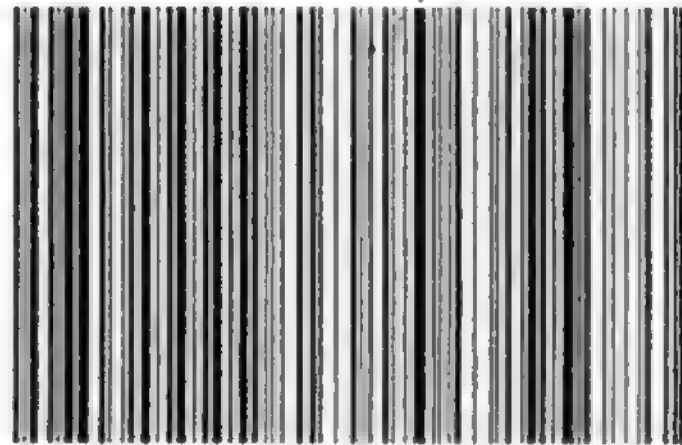
# 1-888-924-VAIO



1. Follow instructions on the other side

Back

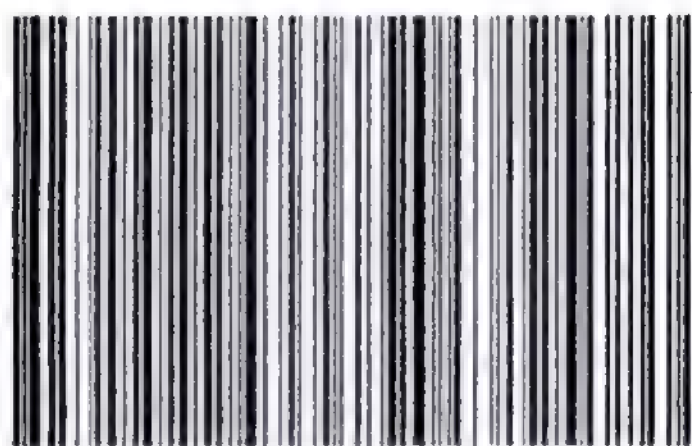
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Inverted Back

1. Follow instructions on the other side

Folded edge of the page



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
  1. Front side touching the free page
  2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
  1. Front side touching the free page
  2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet





## VAIO 505 SUPERSLIM NOTEBOOK



### So light, yet so powerful.

Only 2.7 lbs. and .9" thin. The newest Sony VAIO® 505 SuperSlim Notebooks are even lighter and slimmer than before. Each sports a light, durable magnesium-alloy case inside which you'll find: an Intel® Pentium® processor with MMX™ technology; crisp, clear display; keyboard; heavy-duty hard drive; built-in modem; **Programmable Power Key** for quick access to your e-mail, calendar or browser; plus **Signature Capture** so you can sign digital documents in your own handwriting. What more (or less) could you want in a notebook?

#### Pre-installed Software (both models):

- Windows® 98
- Microsoft® Outlook™ 98
- Microsoft Works
- Adobe PhotoDeluxe®
- Sony Picture Gear™
- Sony DVgate™ Still

#### SONY Exclusive Features (both models):

- i.LINK™ (IEEE-1394) port for DV still image capture
- Pen-based signature and drawing capture
- Programmable power key—Unattended e-mail retrieval

60 days FR  
access, no  
required (n  
hours per d  
hours total)  
restrictions

## THE NEW ALL-IN-ONE NOTEBOOK



### Everything you want in a notebook—built right in.

There's a lot more than an Intel processor inside this slim notebook (less than 7 lbs. and 1.6" thin). Now, the DVD-ROM or CD-ROM, floppy disk and hard drives are all built in—no need to hook up any externals. All three models have even bigger screens than before, with dual battery capability for up to 7 hours<sup>1</sup> of on-the-go power. Plus, each model is loaded with a host of software for some powerful multimedia capabilities. The only thing we didn't add to this notebook was weight and size. So you can see why **3MAX+™** means **MaxMobility**, **MaxScreen** and **MaxBattery** plus a whole lot more.

#### 3MAX+ Features (all models):

- MaxMobility: Less than 7 lbs.<sup>1</sup>; 1.6" thin
- MaxBattery: 2X battery life
- MaxScreen: 14.1" XGA TFT

#### Plus:

- All-in-one design
- i.LINK (IEEE-1394) port for DV still image capture

#### Pre-installed Software (all models):

- Windows 98
- Microsoft Outlook 98
- Microsoft Works
- Adobe PhotoDeluxe
- Sony Picture Gear
- Sony DVgate Still

60 days FR  
access, no  
required (n  
hours per d  
hours total)  
restrictions

<sup>1</sup>Using optional second battery in floppy drive bay. Battery life may vary based on use.  
<sup>2</sup>With weight saver in floppy drive bay.

## THE NEW C1 PICTUREBOOK™

### PCG-C1X

\$2,299.99

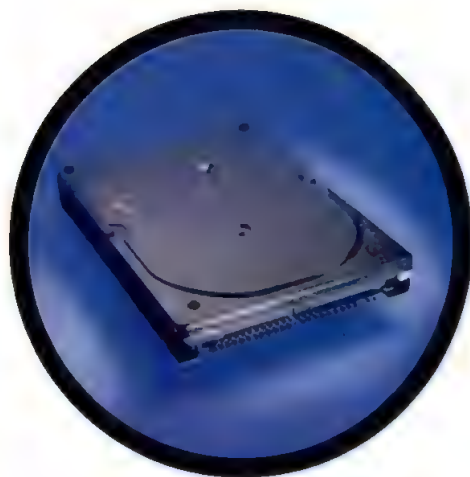
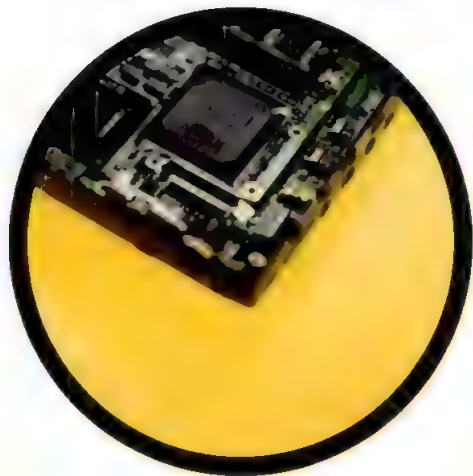


### The new Sony notebook with a built-in digital camera.

This compact wonder makes using digital pictures in documents, e-mail or Websites easier than ever before—because the digital camera is built right in. Just swivel the camera toward your subject and capture video clips or still shots. Pre-installed software allows you to create animated special effects or even a 360° panorama from still frames. Not much bigger than a paperback book, it also delivers full notebook functionality that lets you run Windows 98.

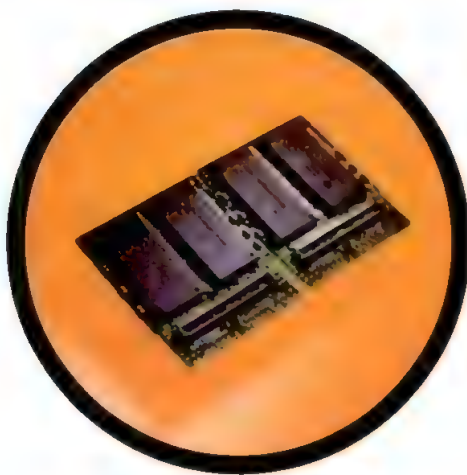
### As low as \$41.51 a month\*

- Intel Pentium processor with MMX technology 266 MHz
- 64 MB SDRAM
- 4.3 GB hard drive
- Built-in CCD video camera
- 8.9" XWIDE™ TFT LCD Display (1024 x 480)
- Windows 98
- Adobe PhotoDeluxe
- Pre-installed original Sony multimedia software with Smart Write™, Smart Publisher™ and Smart Capture™
- 17mm pitch/2mm stroke keyboard
- 2.5 lbs., 1.5" thin
- i.LINK (IEEE-1394) port for DV still image capture
- Magnesium-alloy display housing
- Integrated Universal Serial Bus (USB)
- Integrated V.90 modem
- External USB floppy drive



# CUSTOMIZE

**[ your processor, RAM and hard drive  
only at Sony VAIO Direct™ ]**







# ACCESSORIZE

[ from the growing gallery of  
Sony VAIO® compatibles and add-ons. ]



**Sony VAIO Direct™**  
Great Products. Great People.

# IO DIRECT.



## Sony Digital Mavica Camera

This sleek, semi-pro Digital Mavica® Camera gives you instant imaging and endless storage because it captures all your pictures on floppy disk. Just take your photos and transfer them to any Sony PC—without wires or adapters. Then e-mail them to anyone, anywhere in the world. (For details on the full line of Digital Mavica Cameras, see the reverse.)

**Model: MVC-FD91**  
**Price: \$999.00**



## Sony IC Chip Recorder

With the Sony IC Chip Recorder, you get a palm-sized device (just 2.5 oz.) that captures your voice with digital clarity. And links right to your Sony PC. Giving you a swift, effortless way to save, download and e-mail your voice messages and memos. Holds up to 24 minutes of recording, in five separate message categories. Includes digital VOR that starts and stops with your voice, so you never miss a single word.

**Model: ICD-70PC**  
**Price: \$199.95**



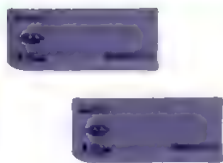
## Sony PC Glasstron Monitor

A big-screen display that's portable? The PC Glasstron™ monitor creates a virtual 30" high-resolution image—for your eyes only. It's head-mounted to offer you the most in mobility and privacy. And its built-in headphones make your multimedia experience even more amazing. Just plug it into your notebook and other video sources and let the games begin!

**Model: PLM-S700**  
**Price: \$2,599.00**  
**As low as \$46.92 a month\***

\*See advisories on back page

## Memory Stick IC Recording Media



Introducing the next generation of digital data storage—Memory Stick™ Media. Smaller than a stick of gum, but with five times the storage capacity (MSA-8A model) of a standard 3.5" floppy disk, Memory Stick Media is expected to become the new industry standard for storage and transfer media. Plus, it makes it even easier for you to transfer images, sounds, data and text between cameras, computers and more.

**4 MB Memory Stick Media Model: MSA-4A Price: \$29.99**  
**8 MB Memory Stick Media Model: MSA-8A Price: \$39.99**

**Sony now builds your PC to order, so don't settle for anything less than a perfect fit. All PC's shipped within 7 days straight from the factory! All other products shipped within 24 hours!**



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**Sony VAIO Direct™**  
Great Products. Great People.

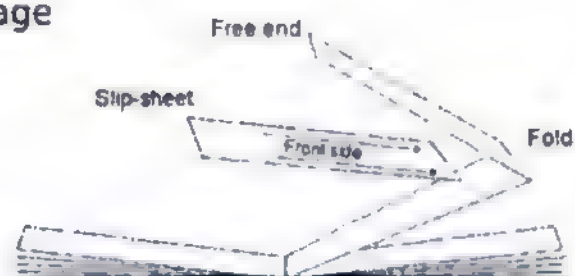
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**1-888-924-VAIO**

SN331-PCM



1. Open the foldout page
2. Insert this sheet with
  1. Front side touching the free page
  2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



### Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

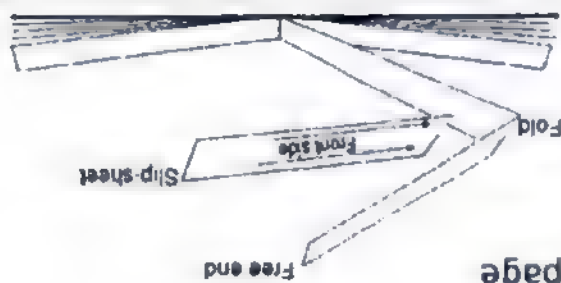
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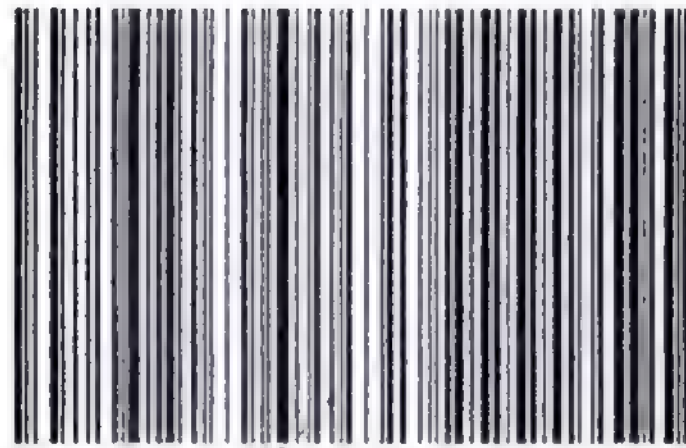
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs5lipBack-0018

Back

1. Follow instructions on the other side



# WAY YOU WANT IT. ONLY FROM SONY VA

## 505 ACCESSORIES



• **External 14X CD-ROM Drive**  
PCGA-CD5: **\$299.99**. AC adapter and PC Card interface supplied. Requires AC power for operation.



• **Leather Carrying Case**  
PCGA-CC5: **\$149.99**—after **\$50** instant rebate. Custom case includes detachable compartments for all of its accessories.



• **Rechargeable Battery Pack**  
**Long-Life:** PCGA-BP52: **\$299.99**. Up to 7 hours with 505TS; up to 6 hours with 505TX.  
**Standard:** PCGA-BP51: **\$149.99**. Up to 3 hours with 505TS; up to 2.5 hours with 505TX.  
Note: Battery life may vary based on usage.



• **Port Replicator**  
PCGA-PR5: **\$99.99**. Ports: Parallel printer, PS/2® keyboard, PS/2 mouse and VGA monitor.



• **Stereo Speakers**  
PCGA-SP51: **\$99.99**. External clip-on speakers that give you even more sound.



• **AC Adapter**  
PCGA-AC51: **\$99.99**. Get an additional AC adapter and keep one at home and one at work.

• **Battery Charger** (available April 1999)  
PCGA-BC5: **\$199.99**. You can charge 2 batteries simultaneously. Compatible with both Long-Life (L) and Standard (S) batteries.

## F160

**\$1,999.99**

## ALL-IN-ONE ACCESSORIES

Order a 2nd Lithium-ion battery now and get a **\$125 rebate**.  
(Rebate period 2/1/99-4/7/99.)

**FREE USB Mouse** with upgrade, a \$49.99 value

### Customize with:

- ★ Upgrade to 128 MB RAM add: \$200.00
- ★ Upgrade to 6.4 GB hard drive add: \$200.00

### As low as \$36.09 a month\*

- Intel Pentium II processor 300 MHz
- 64 MB SDRAM
- 4.3 GB hard drive
- 24X MAX CD-ROM drive
- 14.1" XGA TFT Display
- V90 modem
- High-capacity Lithium-Ion battery, dual battery capability
- 128-bit graphics acceleration
- Built-in stereo speakers
- Digital touch pad

**3MAX+**



• **AC Adapter**  
PCGA-AC71: **\$99.99**. Get an additional AC adapter and keep one at home and one at work.



• **Rechargeable Battery Pack**  
PCGA-BP71: **\$249.99**. Up to 7 hours with F Series.  
Note: Battery life may vary based on usage.



• **Network Port Replicator**  
PCGA-PRF1: **\$199.99**. Built-in Ethernet® 10 Base-T, USB parallel, serial VGA, DC-In, PS/2 keyboard and PS/2 mouse.

## 838

**\$2,999.99**

## 838 ACCESSORIES

10 FREE DVD rentals from NetFlix with purchase\*  
(offer expires 5/31/99)

Order a 2nd Lithium-ion battery now and get a **\$125 rebate**.  
(Rebate period 2/1/99-4/7/99.)

### Customize with:

- ★ Upgrade to 128 MB RAM add: \$200.00

### As low as \$54.14 a month\*

- Intel Pentium II processor 366 MHz
- 64 MB SDRAM
- 6.4 GB removable hard drive
- 2X DVD-ROM drive
- Removable drive bay for DVD-ROM drive, floppy disk drive, second battery, second hard drive
- 13.3" XGA TFT LCD Display
- V90 modem
- High-capacity Lithium-Ion battery, dual battery capability
- 128-bit graphics acceleration
- Built-in stereo speakers
- Digital touch pad

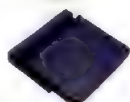
**3MAX**



• **Carrying Case**  
PCGA-CC7: **\$99.99**. Air-cushioned, this case holds your notebook, AC adapter, extra battery and floppy or CD-ROM drive.



• **AC Adapter**  
PCGA-AC71: **\$99.99**. Get an additional AC adapter and keep one at home and one at work.



• **Network Docking Station**  
PCGA-DB8: **\$599.99**. Offers everything you need to connect your notebook to your company's PC network.



• **Rechargeable Battery Pack**  
PCGA-BP71: **\$249.99**. Up to 8 hours with 800 Series. Note: Battery life may vary based on usage.

• **Extra 4 GB Hard Drive**  
PCGA-HD740: **\$499.99**. Placing a second 4 GB hard drive in the versatile drive bay increases your storage capacity for large applications.

**www.sony.com/vaiodirect-yourPC**

# SONY DIGITAL MAVICA CAMERAS

Choose from four different models:

## The world's only floppy-disk digital camera.

The Sony Digital Mavica® Camera isn't just the world's favorite digital camera. It's the only digital camera in the world to use a standard floppy disk for film. So it works seamlessly with any PC. And gives you an effortless way to do some pretty amazing things.

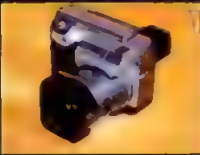
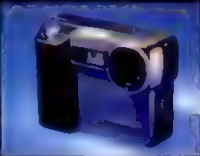
Just point, shoot and preview your images on the camera's color LCD display. Pop the floppy in your PC and e-mail your images, post them to the Web or use them to create a polished presentation. Some models even let you record up to 60 seconds of live video and audio on a single floppy. So you can do things like e-mail a video clip of your newborn baby—complete with sound—just minutes after she's born.†

It's easy to imagine all the amazing things you could do with a Digital Mavica Camera. The tough part is deciding which of our five models is best suited to helping you make it all happen.

### Sony Citibank Platinum Select Card

Use the Sony Citibank® Platinum Select™ Card with any purchase and get triple Sony points towards Sony movies, music, electronics and games. Apply today.



|                                                                                    |                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MVC-FD91</b>                                                                    | <b>\$999.00</b>                                                                                                                                                                                                              |
|   | Designed for the serious photo enthusiast, this semi-pro model is loaded with top-of-the-line features, like MPEG audio/video capabilities, a 14X Optical Zoom lens, Optical SteadyShot™ and special manual controls.        |
| <b>MVC-FD81</b>                                                                    | <b>\$799.00</b>                                                                                                                                                                                                              |
|   | This model comes with most of the perks of our semi-pro model, plus all the great features of our standard Mavica Cameras. Highlights include: XGA picture quality, as well as MPEG audio/video and voice memo capabilities. |
| <b>MVC-FD71</b>                                                                    | <b>\$699.00</b>                                                                                                                                                                                                              |
|   | Designed specifically for capturing images for use in e-mail, Websites and presentations, this model offers VGA picture quality, 10X Optical Zoom and a sleek, lightweight design.                                           |
| <b>MVC-FD51</b>                                                                    | <b>\$499.00</b>                                                                                                                                                                                                              |
|  | This model offers practical features such as VGA picture quality, a 2X floppy disk drive, a color LCD screen and built-in Intelligent Flash.                                                                                 |

# SONY

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SN331-PCM



where you have more choices as to how to build your page.

Tripod offers 12 templates to choose from to get started, but 10 of them are of very limited use because of their restrictiveness. Of the 10, we can recommend only the Personal Page, Photo Album, and Company Page to absolute beginners. These walk you through a wizard that lets you fill in elements such as your company logo and some contact info in predefined locations that you can't move. If you want to edit the page, you have to go through the wizard again.

Somewhat better are the two templates with more general layouts. These define only the look and feel of the page; you have seven options, such as text block, image, or links, to put in each block on the page. You can build a decent-looking page or string together a number of pages to create a site with a consistent style. These template pages can be edited in the free-form editor (a glorified Web-based Notepad), but, as with Angelfire, once you convert the template pages to HTML for the editor, you can't use the template again.

To go beyond this, you have to use the free-form editor or upload pages you've built already. Tripod supports FrontPage 98 extensions, so you can create your site on your PC, upload it to Tripod, and use Tripod just for hosting.—*Adam Asch*

### Xoom

[www.xoom.com](http://www.xoom.com). Free Web space: 11MB. Cost: Weekly e-mails to your box with special offers. Premiums: None.

● One of the most basic page-building sites yet in some ways the most elegant, Xoom offers beginners an opportunity to create a page or a site easily. It delivers some notable elements, such as a chat room for your site and ad-free pages, but you'll quickly outgrow Xoom because of its lack of advanced page-creation tools. Homestead or GeoCities has a better upward path from newbie to Webmaster.

Building your new home page on Xoom is simple. You get an inordinate amount of hand-holding as you go from page to page in its forms-driven Easy Page Builder wizard. Choose a template to start: Most give you room for five text or image placements per page, and your

only choice is on which side of the page you want them to appear.

The templates are restrictive in that you must choose one of the five background images each template offers and put an e-mail link on every page you create, whether you want these or not. Tripod, for example, lets you leave sections of its two layout-driven templates blank and gives you more options for backgrounds, type styles, and colors.

Xoom does offer some excellent features that many others lack. In fact, its Java-based chat room can be plugged into another Web site; all you need to do is register at Xoom, indicate where your site is, and copy the HTML code you need to place it on your page.

A big Xoom drawback, though, is that to go beyond the basics of your template site, you must create the pages yourself off-line and upload them manually to Xoom's site using your own FTP client. Xoom is the only site in this roundup that doesn't include even a blank form for pasting in HTML code to create pages.—*AA* 

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• **WIRELESS** network kits use radio-frequency (RF) technology (much as cordless phones do) to transmit data throughout the house. The linked PCs can be anywhere in the house, so a wireless network is the most appealing solution for the home. We found performance adequate but not stellar.



• **PHONE-LINE** kits piggyback the data signal on top of the phone wiring already in your walls. These kits performed better in our labs than the wireless kits did, and are inexpensive. You do need to have a phone jack near where you want each PC, however.



• **POWER-LINE** kits send the signal over your home's AC wiring. In theory, this lets you place machines wherever there's an outlet, but the outlet can't be too far from your transformer. And we found that washing machines, dishwashers, and the like can cause interference and slow throughput.



• **WIRED** kits, such as Ethernet kits, are by far the fastest and most reliable. They are the ideal choice for home offices or for sharing a fast Internet connection. As you have to run wire to each machine, one of these kits is best as a one-room solution—unless you're building from scratch.



# Network YOUR Home

**We found that the current crop of home network kits vary widely in speed and reliability.**

**By Les Freed**

**S**ix months ago, people gave you funny looks if you told them you had a home LAN. Today, home networking kits are among the hottest items on trade show floors and in retail stores. The reason is simple: Now that home PC prices have come crashing down, many users have purchased second or third PCs for the home. In most cases the hand-me-down machines end up in the kids' rooms—with no printer and no dedicated phone line for Internet access. Of course, it never fails that just as Mom sits down at the PC to check her e-mail, one of the kids needs to do some research on the Web or print out a homework assignment. Add to the mix all the business professionals who regularly shuttle laptop PCs to and from the office and the urgent need to share resources starts to make sense.

That's where the home local area network comes in. If all the PCs in your house are connected to a LAN, any PC on the network can use the printer, share a device (such as a Zip Drive), or transfer files simply by using the networking functions built into Windows 95 and 98. Even more alluring, only one machine needs an Internet connection to give all PCs on the LAN a gateway to the Web. So your kids can surf the Web while you read e-mail, and either of you can print to the printer from your local machine.

Along with the growing need, other

factors have come together to make the time ripe for home LANs. First and foremost, prices for the kits are attractive to home purchasers—as low as \$90 for a kit to connect two machines. Also important for the home market, some entries are easy to install and require no new cabling; they work over your home's existing phone or electrical wires, or through wireless radio-frequency (RF) transmitters.

For our testing, we gathered 11 networking kits designed specifically for the home and small-office marketplace. They include a variety of wired and wireless technologies, ranging from reliable old 10Base-T Ethernet to the latest RF, power-line, and phone-line networking technologies.

## WIRED FOR SPEED

Without a doubt, wired home kits using traditional Ethernet cabling (such as the products here from NDC, Netgear, and 3Com) or proprietary cabling (such as the Anchor Chips EZ-Link Instant Network) deliver unsurpassed performance. These are the best solution for home-office setups (or even some small offices) where all the PCs are in the same room, since all you need to do is run the cabling along the baseboards. These are also the best choice if you have (or plan to add) a fast Internet connection: If you're sharing a cable modem or a DSL connection at 1.5 Mbps or better, only the kits with dedicated wires can deliver the full

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## Editors' Choice

### • Proxim Symphony Cordless ISA Card



*Though the kits with dedicated wires offer the best raw throughput, we feel the convenience and flexibility of wireless solutions make them the right*

*choice for the majority of home users.*

In that regard, the best home networking kit we tested is the Proxim Symphony Cordless ISA Card (\$150 street per PC). Its relative speed and reliability put it ahead of the other RF products we tested, and it was one of the easiest to set up and use. Proxim also offers the widest range of connectivity solutions, including a PC Card for notebooks to allow roaming around the house or even up to 300 feet outdoors. And the Proxim provides effective Internet sharing for all types of connections, from analog dial-up to high-speed cable and DSL.

An honorable mention goes to the affordable ActionTec ActionLink Home Networking Kit (\$90 street for two PCs). This phone-line kit boasts well-thought-out software, from the setup routine to the Internet-sharing program. Even better, it delivers fast

throughput, particularly for shared Internet connections over a network. Its only drawback is the lack of a PC Card interface to work with a laptop computer.

If you can run dedicated cabling to each PC, three of the wired kits are worth your consideration. The NDC SOHware Fast Ethernet Network Starter Kit (\$110 for two PCs) and Netgear FB104 (\$130 for two PCs) are both 10/100Base-T Ethernet kits that deliver the best performance we saw. If you have (or will have) a fast Internet connection and aren't afraid of running some wire, either of these is the way to go. Finally, the Anchor Chips EZ-Link Instant Network (\$90 for two PCs) is ideal for linking up your home desktop with the laptop you shuttle to and from the office. Its USB-connected cable delivers great throughput, though the 15-foot limitation makes it a single-room solution only.

bandwidth. And since Ethernet is an industry standard, you can add other devices from dozens of vendors to an Ethernet LAN with no compatibility concerns.

#### LOOK MA, NO WIRES

If your second PC is in another room, you may find it difficult or downright impossible to run a cable, especially if the two PCs are on different floors. That's where the wireless kits fit in.

The products in our review group represent three different approaches to wireless networking. The radio-frequency kits—the Diamond HomeFree Wireless,

InnoMedia InfoAccess, Proxim Symphony Cordless ISA Card, and WebGear Aviator Wireless Networking Kit—use radio waves to send signals from one PC to another, much the way a cordless telephone does. Because the radio signals these devices use are relatively weak, they have limited range and can be subject to interference from other radio-frequency devices. Their main advantage is that they let you put your PCs wherever you like: The radio signals can permeate walls and floors and will even reach a short distance outside of the house. The Proxim system (\$150 street per PC), our Editors' Choice, is a

good idea if you have a laptop PC and want to be able to connect from the backyard.

The Intelogis PassPort Plug-In Network uses the AC power wiring in your house to carry radio signals from one PC to another. Although it should work with any AC outlet in your house, we found that it simply wouldn't work with some outlets in one of our test homes.

A third group of products—the ActionTec ActionLink Home Networking Kit and Diamond HomeFree Phone-line—operate in a similar fashion but use your home's phone wiring instead of the power wiring. The LAN signal rides piggyback on top of your normal phone signals but doesn't interfere with them. Each of these products uses a 5.5- to 9.5-MHz channel—a higher frequency than ordinary phones use, so you can use the local network even while talking, faxing, or surfing the Internet, all on the same phone line. On the downside, each PC must be located near a telephone jack, which may be a problem if you don't have a jack everywhere you want to put a PC.

#### SOME ASSEMBLY REQUIRED

In general, the home networking kits were easy to install, although some were easier than others. All of the Ethernet kits—as well as the ActionTec, Diamond, and Proxim products—require that you open up your PC to install a network card. Although this is normally a simple task, adding an expansion card can be a daunting task for the uninitiated. The other kits attach via your PC's serial, parallel, or USB ports, reducing installation time and minimizing the probability of conflict with other devices in your PC. The downside, of course, is that you lose a valuable serial or parallel port.

Also note that we occasionally ran into trouble installing products on machines that had been previously networked, or laptops that had network settings from office LANs. Products from Diamond were more challenging in this regard, while others installed without incident.

For Internet sharing, you'll need a hardware or software router, or a piece of software called a *proxy server* to share your modem, cable, or DSL connection over the LAN. A proxy server runs on the PC that is physically attached to the Internet connection, and the server acts as a

**Our Contributors:** LES FREED and M. DAVID STONE are contributing editors of *PC Magazine*. JOSH LEVY is a *PC Magazine* staff editor. JEFFREY G. WITT is *PC Magazine*'s technical director responsible for networking and communications. KEVIN YOUNG was the project leader, and senior associate editor JAMIE M. BSALES was in charge of this story.



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# PC EDITORS' HOT LINKS

## www.pcmag.com/hotlinks

For comprehensive coverage of the latest networking products—including the complete text of this story—log on to our Web site. Also check out our labs-based reviews of modems and Internet service providers.

### ► Home Phoneline Networking Alliance

www.homepna.org

A corporate association working to develop a single standard for phone-line networking in the home and office. It aims to bring to the mass market a range of easy-to-use, interoperable phone-line network products that meet a common standard.

### ► HomeRF Working Group

www.homerf.org

An industry working group dedicated to establishing a uniform standard for wireless radio-frequency digital communications in the home—specifically SWAP (the Shared Wireless Access Protocol). It aims to solidify and develop voice and data sharing between PCs and PC-enhanced cordless phones; Internet access from anywhere around the home; sharing ISP connections between PCs and other devices; sharing files, modems, and printers in multi-PC homes; and voice-activating other home electronic systems via a PC-enhanced cordless handset.

### ► Bluetooth Special Interest Group

www.bluetooth.com

News and discussion of the Bluetooth radio-technology specification for low-cost, short-range links between mobile PCs, mobile phones, and other portable devices. Bluetooth devices permit fast ad hoc connections between peripherals and PCs.

gateway between the Internet and your LAN. Although Internet sharing is the number-one home LAN application, we were surprised to see that four of the tested products don't include the needed software in the box. The Netgear FB104 Ethernet kit, for example, clearly mentions "Internet sharing" on the outside of the box, but inside there's no mention of any Internet-sharing software.

There are several excellent and inexpensive proxy servers on the market, two of the most popular being WinGate Home (\$40, [www.deerfield.com](http://www.deerfield.com)), from Deerfield, and WinProxy Lite (\$60, [www.ositis.com](http://www.ositis.com)), from Ositis Software. Both of these products can operate with any type of Internet connection, and both provide dial-on-demand and automatic inactivity discon-

nect features for dial-up connections. Both are very easy to install, and they require only minimal CPU and memory overhead on the server PC.

The throughput of our test kits ranged from 85 to 100 Mbps, and we didn't see a huge performance hit when they were sharing a 56-Kbps Internet connection or a printer over a LAN. But the speed differences became very apparent when we attempted to copy a large file over the LAN; what took seconds over Ethernet took several minutes on some of the wireless products. And it's worth noting again that the slower products don't have enough bandwidth to handle fast Internet connections.

## ActionTec ActionLink Home Networking Kit

2-node phone-line kit (expandable to 25 nodes); PCI; \$90 street. Sunnyvale, CA; 800-797-7001, 408-752-7700; [www.actiontec.com](http://www.actiontec.com); 508 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

The ActionTec ActionLink Home Networking Kit goes a step farther than most phone line-based systems, giving you exceptionally well-thought-out software, from the setup routine to the Internet-sharing program. Even better, it delivers fast throughput, particularly for shared Internet connections over a network. Its only drawback is the lack of a PC Card interface, which would let it work with a laptop computer.

The kit includes two PCI cards, two phone cables, and a highly informative manual. To set up the network, you install the PCI cards, plug the cable into the nearest phone jack (there is a pass-through for your phone), and install the

software. The manual includes step-by-step instructions, complete with useful screen shots. More important, it shows you where to find the changes that setup should make on your system—which is invaluable if something goes wrong. You'll also find a diagnostic utility that can help you identify most problems.

The bundled Internet gateway software, ActionTec's own DynaNat, is far better than most. Not only will it let you share an Internet connection but if the preferred gateway machine isn't on, the software will automatically switch to another system with a modem. Best of all, there's no noticeable difference in speed between browsing over the network and browsing with the same 56K modem on a standalone machine. And like the Diamond Home-Free Phoneline, also reviewed here, the ActionLink lets you use the network even while talking, faxing, or surfing the Internet. File transfer over the network is reasonably speedy as well; the ActionLink (and the Diamond product, for that matter) took 53 seconds to transfer our 5.6MB test file, versus several minutes for the RF and power-line entries.

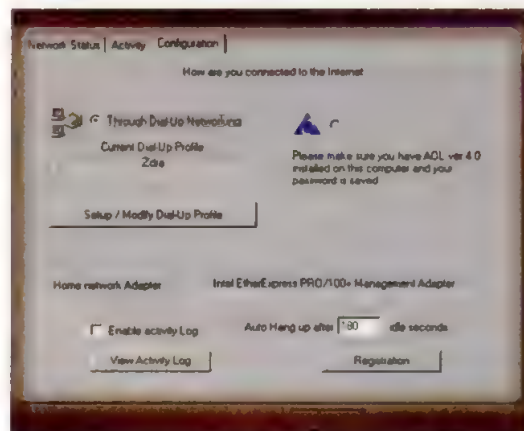
For ease of setup and operation, the ActionLink kit is hard to beat.—*M. David Stone*

## Anchor Chips EZ-Link Instant Network

2-node proprietary-cable kit (expandable to 17 nodes); USB; \$90 street. San Diego; 619-613-7900; [www.ezlinkusb.com](http://www.ezlinkusb.com); 509 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

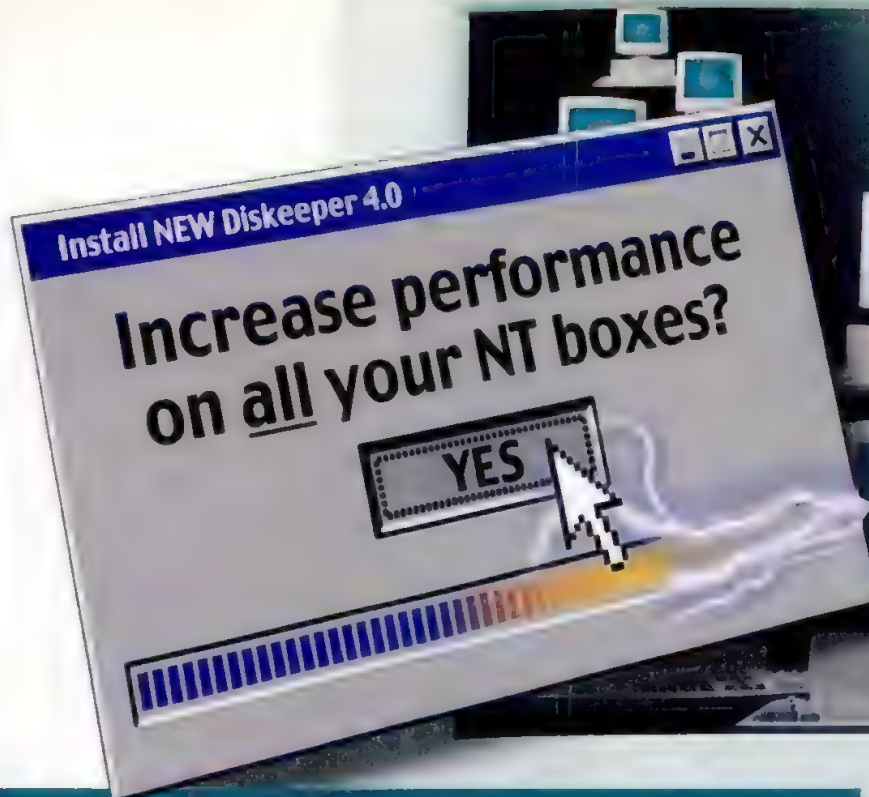
The Anchor Chips EZ-Link Instant Network is a speedy, inexpensive kit, ideal for tying your home desktop PC to a notebook that you take to the office and back. It is best as a single-room solution, rather than as a way to connect multiple home PCs: Besides requiring you to run cable to each PC, it connects via USB, which means each PC must be a fairly recent machine running a USB-enabled version of Windows 95, or preferably Windows 98. The EZ-Link doesn't include Internet-sharing software, though the manual does a good job of discussing proxies and gateways, and it includes Web addresses for popular shareware programs.

Each EZ-Link package includes a net-



The intuitive interface of the ActionLink makes setup and configuration easier than with the other products we tested.





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**Ease of use.** These products are meant for home users who have little or no network expertise, so it is essential that setup and use are uneventful. Better products include clear, informative documentation and troubleshooting help.

**Internet sharing.** We rate how seamlessly the product lets you share an Internet connection among multiple machines, and how well it works. An N/A in this category indicates that the bundle does not include the necessary software but that you can add it separately.

**Laptop integration.** For many users, being able to connect and sync their laptop PCs with their home machines is the reason they look to home networking kits. We rate how easy it is to attach a laptop and have it recognized as a network node.

**Robustness.** Here we evaluate the relative speed of a product, and whether its throughput is sufficient for typical day-to-day chores. This rating also takes into account a product's range and its susceptibility to interference.

|                           | ActionTec<br>ActionLink | Anchor<br>Chips<br>EZ-Link | Diamond<br>HomeFree<br>Phoneline | Diamond<br>HomeFree<br>Wireless | InnoMedia<br>InfoAccess | Intelogis<br>PassPort | NDC<br>SOHOware | Netgear<br>FB104 | Proxim<br>Symphony | 3Com<br>Office-<br>Connect | WebGear<br>Aviator |
|---------------------------|-------------------------|----------------------------|----------------------------------|---------------------------------|-------------------------|-----------------------|-----------------|------------------|--------------------|----------------------------|--------------------|
| <b>Technology</b>         | Phone line              | USB                        | Phone line                       | RF                              | RF                      | Power line            | Ethernet        | Ethernet         | RF                 | Ethernet                   | RF                 |
| <b>Street price</b>       | \$100                   | \$90                       | \$100                            | \$200                           | \$190                   | \$180                 | \$110           | \$130            | \$150              | \$120                      | \$150              |
| <b>Ease of use</b>        | Good                    | Good                       | Fair                             | Fair                            | Good                    | Good                  | Fair            | Fair             | Good               | Fair                       | Good               |
| <b>Internet sharing</b>   | Excellent               | N/A                        | Fair                             | Good                            | Poor                    | Poor                  | N/A             | N/A              | Excellent          | N/A                        | Fair               |
| <b>Laptop integration</b> | N/A                     | Good                       | N/A                              | Fair                            | Fair                    | Fair                  | N/A             | N/A              | Excellent          | N/A                        | Good               |
| <b>Robustness</b>         | Good                    | Good                       | Fair                             | Fair                            | Poor                    | Fair                  | Excellent       | Excellent        | Fair               | Excellent                  | Poor               |

N/A—Not applicable. The base kit does not include this feature.

work module with a cable, an additional 5-meter cable, and a short installation guide. The manual, alas, is online-only, but many users won't need it at all—except for the support phone number, which is missing from the setup guide.

Installation is simple, and it's fully covered in the guide. Just run the setup routine, plug in the cables, and tell Windows which drives and printers to share. You need only one EZ-Link module to connect the first two computers' USB ports, but you'll need another for each additional system. Note that we installed the EZ-Link on a notebook that already had a 3Com Ethernet card, and we moved the system between the EZ-Link and the prior network without problems. The EZ-Link proved very speedy on our test, transferring our 5.6MB file in just 11 seconds (on a par with the 3Com Ethernet kit).

If you have USB ports and Windows 98 on all your systems—and no walls or floors to connect through—the EZ-Link should be high on your short list.—*MDS*

## Diamond HomeFree Wireless, HomeFree Phoneline

**HomeFree Wireless.** 2-node 2.4-GHz RF kit (expandable to 16 nodes); ISA, PC Card, PCI; \$200 street. **HomeFree Phoneline.** 2-node phone-line kit (expandable to 16 nodes); PCI; \$100. San Jose, CA; 800-468-5846, 408-325-7000; [www.diamondmm.com](http://www.diamondmm.com); 510 at [www.pcmag.com/infoink](http://www.pcmag.com/infoink).



Diamond Multimedia is jumping into the consumer network

space with both feet, delivering products that require no new wires and provide transparent Internet sharing at a decent price. The Diamond HomeFree Wireless is our second-favorite RF product here (just behind the elegant Proxim entry), and the Diamond HomeFree Phoneline is a contender, though the very similar entry from ActionTec was a little more user-friendly.

The install procedure differs for the two products, though each requires that the gateway machine be on at all times (some machines can be in power-saving or sleep modes, depending on their BIOSs) during initial setup and during general operation to enable Internet sharing. (The ActionTec phone-line package works around this limitation.) We also ran into problems during installation, which Diamond attributed to our having networking previously installed on our test machines. To get the installation routine to work on some machines, we had to install the operating system from scratch on a clean machine—a last resort. Other times, the install worked just fine. The manual doesn't warn you of such potential conflicts before you begin.

The radio-frequency HomeFree Wireless, which uses the easy-to-use software router WinNAT for sharing Internet connections, is available in two forms: the Desktop Pac, which includes an ISA and a PCI card, and the Combo Pac, comprising an ISA card and a PC Card for notebook users. Each additional ISA or PCI card

sells for \$100 street; an extra PC Card sells for \$130. If all goes well, installation requires little more than opening your two systems, plugging in the cards, and following the software installation instructions in the Getting Started manual.

As with the RF products from InnoMedia and WebGear (but unlike the Proxim entry), the HomeFree Wireless's throughput was disappointing; it needed almost 5 minutes to transfer our 5.6MB file. On the whole, we preferred the better-performing and better-behaved Proxim RF solution.

The HomeFree Phoneline's installation procedure includes a graphical display of your new network and the machines' logical relationships, a nice touch. Based on the same AMD PCnet-Home chip as the ActionTec ActionLink Home Networking Kit, the package includes two PCI cards, two phone cables, and a Getting Started manual. The software includes the proxy server WinGate, which does a good job of shielding the users from the complexities of Internet sharing. Note that as a PCI-only solution, this isn't the right choice for connecting a laptop to a home network.

The product fared much better than the wireless version on our speed test, transferring our 5.6MB file in just 53 seconds. Again, if your target machines have never been networked, this Diamond product is worth a look. But be sure to consider the very similar ActionTec product as well.—*Jeffrey G. Witt*



January

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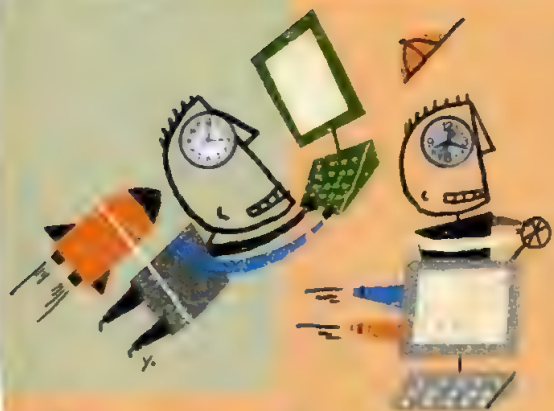
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## Household Acceleration



While the demand for home networking is beginning to explode, one hurdle has yet to be fully overcome: speed. We

found that only the wired kits deliver performance adequate for sharing a fast Internet connection among several PCs. Four vendors—Avio, Enikia, Epigram, and ShareWave—have already designed prototype products that push the performance envelope. All four designs employ the “no new wires” precept to leverage existing home infrastructures. Products are scheduled to ship later this year and early next year.

Epigram ([www.epigram.com](http://www.epigram.com)) plans to push phone-line networking from the current 1-Mbps speed of the ActionTec and Diamond products we tested to 10 Mbps. The chip sets, dubbed iLine, use sections of the 2- to 30-MHz frequency range, thus avoiding interference with phone calls, faxing, and DSL transmission. The modulation technique used to squeeze more bandwidth from the pair of copper wires encodes 8 bits of data per symbol, and throughput of up to 100 Mbps is expected in the near future. That's the same territory Avio Digital ([www.aviodigital.com](http://www.aviodigital.com)) is headed toward with its MediaWire Home Network: The company claims throughput of 98 Mbps. Epigram has licensing agreements with Netgear, Texas Instruments, and 3Com, and products should appear this year. Products based on the Avio chip should arrive in 2000.

The ShareWave Digital Wireless solu-

tion ([www.sharewave.com](http://www.sharewave.com)) comprises multiple technology components, including the physical radio, compression algorithms for throughput, and ShareWave's own set of networking protocols. The ShareWave Cresta Digital Radio operates in the 2.4-GHz range (like the Diamond and Proxim products in our main roundup), but it uses Direct Sequence Spread Spectrum (DSSS) as opposed to Frequency Hopping Spread Spectrum (FHSS) for its radio transmission. Consequently, ShareWave claims data throughput of up to 4 Mbps, as well as greater immunity from interference from microwave ovens, cordless phones, and the like.

To negotiate the bandwidth required for full-motion video or other multimedia applications, ShareWave's Network Adaptive Multimedia Image (NAMI) compression is embedded in hardware, capable of a 70-to-1 ratio, achieving an effective throughput of 120 Mbps. To let ShareWave-enabled devices talk to one another, the Whitecap network protocol handles issues such as error correction, quality of service, security authentication, and isochronous communication, which is crucial for delivery of real-time content. ShareWave's solution will first be available in home entertainment products from Philips, and it will let any TV share a PC's functions, including software applications and Internet access.

More ambitious is the proposal from Enikia ([www.enikia.com](http://www.enikia.com)), which has a proprietary modulation technique to push 10 Mbps over your home's current AC wiring—well above the 350 Kbps we saw from the Intelogis product. Enikia claims that its product reacts to line noise differently, by sensing available bandwidth and degrading the signal gracefully, rather than forcing data through the interference. At press time, Enikia had announced no partner relationships, but the company's reference designs include Ethernet transceivers, a modem-based gateway, and network adapters with parallel, USB, and Ethernet interfaces. —Jeffrey G. Witt

## InnoMedia InfoAccess

2-node 900-MHz RF kit (not expandable); serial; \$190 street. San Jose, CA; 888-251-6250, 408-562-3535; [www.innomedia.com](http://www.innomedia.com); 511 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).



The InnoMedia InfoAccess is a wireless networking system that lets two (and only two) PCs share files, printers, and an Internet connection. Unfortunately, it was the slowest and generally the most troublesome product we tested. Add incomplete documentation and poorly labeled devices and it's a poor choice for any home network. The complex WinProxy Internet-sharing software is also not appropriate for the home market. Other products in this roundup are better buys.

The InfoAccess package includes two 900-MHz wireless adapters, serial cables, power transformers and adapters, a driver disk, and a copy of Osis Software's WinProxy Lite. Installation is simple in theory: Just hook up the cables, turn on the power, and install the InfoAccess software. During testing, however, the product didn't connect consistently—and the LEDs and the Link or Sync switch are never explained in the manual. Additionally, the InfoAccess can't support an external modem if you don't have a second port.

After you complete the installation and reboot the PCs, you can access shared files and printers on both machines. The client PC can access the Internet via WinProxy on the gateway machine. WinProxy takes care of auto-dialing into the ISP on demand, and it drops the ISP connection after a user-definable period of inactivity. To connect to the Internet through the proxy server, however, you must manually configure the browser on the client PC. The documentation clearly explains how to do this, but it's not a user-friendly approach and might intimidate novice users.

Internet connections (at 56K) through the WinProxy server weren't noticeably slower than usual, but file transfers were painfully slow. InfoAccess took almost 24 minutes to copy our 5.6MB test file—about 13 times as long as the Proxim wireless product.

The slow speed and two-PC limitation make this product impossible to recommend, especially in view of the more robust and less expensive offerings from ActionTec, Proxim, and Diamond. —Les Freed



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# New

## Contenders

The home-networking arena is now bursting with new products, and many more are on the way. Here's what to expect at your local computer superstore.

- The **Best Data Home PC Link Kit** (\$200 street) is a basic phone-line networking solution built around the Internet-sharing package WinGate. It includes a 56K V.90 PCI Internet Gateway Card modem, a separate PCI-based Home PC Link Station Card for a single machine, and the WinGate software. (Best Data Products Inc., Chatsworth, CA; 818-773-9600; [www.bestdata.com](http://www.bestdata.com).)
- Based on the same chip as the Action-Tec and Diamond phone-line products, the **Linksys HomeLink Phoneline Networking** system (\$90) lets you set up a home network over your home's phone lines. The PCI card includes a 10Base-T Ethernet port, in case you ever want to upgrade your network to Ethernet. (Linksys, Irvine, CA; 949-261-1288; [www.linksys.com](http://www.linksys.com).)
- If wireless networking is your game, consider the **ZoomAir**, from Zoom Telephonics and Harris Semiconductor. This 2.4-GHz wireless networking kit consists of an ISA NIC, a PC Card NIC, and ZoomAir Access Point Software, and it sells for \$110. The ZoomAir uses the Harris Prism Radio Chip Set to produce data transfer speeds of up to 2 Mbps. It has a typical indoor range of 300 feet and an outdoor range of 1,000 feet. In addition, the ZoomAir has a spread-spectrum data protection mode that resists noise, interference, jamming, and unauthorized monitoring. (Zoom Telephonics Inc., Boston; 800-666-6191; [www.zoomtel.com](http://www.zoomtel.com).)
- The **IBM Cordless Computer Connection** (\$55) takes a different approach: It's not a network but a modem extender. The base unit looks like a cordless phone console with an antenna; you just plug it into your wall's RJ-11 jack and plug the mobile unit into the RJ-11 jack on your notebook computer's PC Card modem. Then you can wander the yard or room without losing your Internet connection. The range is 200 feet. (IBM PC Co., Armonk, NY; 800-426-4832; [www.pc.ibm.com](http://www.pc.ibm.com).)—*Josh Levy*

## NETWORKING

### Home Networking

#### Intellogis PassPort Plug-In Network

2-node power-line kit (expandable to 20 nodes); parallel; \$180 street. Draper, UT; 877-468-3564, 801-571-4000; [www.intellogis.com](http://www.intellogis.com); 512 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

① The Intellogis PassPort Plug-In Network turns your home's AC power wiring into a 350-Kbps network. The PassPort is easy to set up and install, though Intellogis has done nothing to ease the complexity of installing the proxy server; the installation procedure asks numerous questions about IP addressing and port numbers that would intimidate any networking novice.

The basic kit includes connections for two PCs and one printer, with excellent documentation, as well as Osis's Win-Proxy software, which lets you share any type of Internet connection. The PassPort's strongest suit is its ease of connection. Simply connect the PassPort—a white plastic box about the size of a paperback book—to your PC or printer and plug it into the wall. It connects to your PC via the parallel port, so you can install it without opening up your PC's case. But it has no pass-through for other parallel-port devices—a problem if you've invested in a parallel-port scanner or Zip Drive. The kit includes two special outlet strips designed to prevent interference from other devices in your house. For this to work, though, you can't plug the kit

into power strips or conditioned lines, and you may not be able to use the product in any outlet if there are excessive lengths of power line cabling to your transformer (so be prepared to search for usable outlets).

Once you've set up the proxy server, the bundled PassPort Administrator helps you configure your network. Microsoft's Network Neighborhood feature is used to share files and printers.

During operation, we found that household appliances like dishwashers and washing machines can cause interference. And the PassPort wouldn't work on every outlet; we had to move the units around to several different outlets before we got a rock-solid connection. In performance testing, the PassPort was one of the slowest units—adequate for typical printer-, file-, and modem-based Internet sharing but too slow for sharing a cable or DSL connection.

This is a decent product for 56K modem users leery of opening their computers. But the interference and voltage problems (and somewhat slow speed) would make us opt for an RF or phone-line solution.—*LF*

#### NDC SOHware Fast Ethernet Network Starter Kit

2-node Ethernet kit (expandable to 5 nodes per hub); PCI; \$110 street. Sunnyvale, CA; 800-632-1118, 408-730-0888; [www.sohware.com](http://www.sohware.com); 513 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

② The NDC SOHware Fast Ethernet Network Starter Kit provides 100-Mbps Fast Ethernet speed at a 10-Mbps price. Like the other Ethernet kits in this roundup, it provides basic PC-to-PC connectivity but no Internet-sharing software (though you can buy your own, or add a router). The SOHware also requires that you handle the wiring yourself if you want to extend your network beyond a single room. It's a good solution only if you're ready for full-scale Ethernet networking.

The SOHware's NICs are auto-sensing 10/100 PCI cards, so you can use them with either 10- or 100-Mbps hubs. NDC includes drivers for NetWare, Windows 95, Windows NT, and Windows for Work-



Intellogis's PassPort Administrator helps you configure your network, making setup a breeze.

groups on a single floppy disk, and a flyer





# Things you won't need to install a Symphony cordless home network.



It's easy to share Internet access, printers, files, and enjoy multiplayer games without cables.

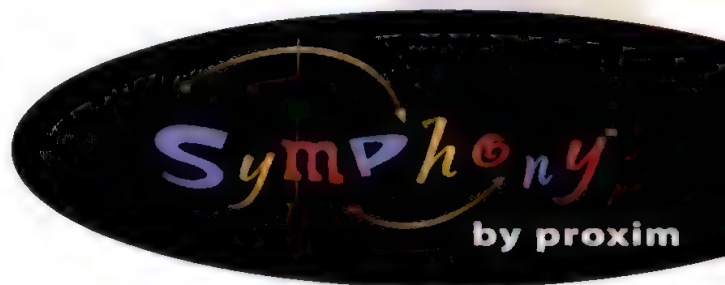
First, came the cordless phone. Now, Proxim™ introduces the cordless computer network for the home. Now you can get all the benefits of high speed home networking without the hassles of installing a wired network or the high cost of having someone else do it for you.

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So save your tools for more important projects. Check out the Proxim Symphony cordless home networking solution—and where you can buy it—at [www.proxim.com/symphony4](http://www.proxim.com/symphony4) Or call us at 1-888-549-3758 for full details.





PERFORMANCE TESTS

# Home Networks



Home network kits vary widely in performance and features. Our test results show that if you're looking to do anything more intense than basic file- and printer-sharing, you should shorten your list of candidates.

Also consider how well a product deals with typical household environmental factors. On balance, Ethernet products lead the pack when it comes to performance and resistance to interference. On the other hand, a few of the non-Ethernet products delivered an acceptable level of environmental resistance and enough muscle on file-transfer tests to make them appealing. In particular, the Anchor Chips and Proxim kits, as well as the two phone-line products (from ActionTec and Diamond) probably have enough bandwidth to satiate your home networking needs for the next few years.

To establish a performance reference, we set up the products under the best conditions we could find and then timed file-transfer speeds. As expected, the wired kits did particularly well. Three products—from Innomedia, WebGear, and Intelogis—did particularly poorly. The InnoMedia solution is bottlenecked by its serial connection and is rated at only 85 Kbps. In our labs it didn't achieve even that, taking almost 24 minutes to transfer a 5.6MB file. The WebGear and Intelogis kits were also relatively slow, each taking more than 6 minutes for the same file. In defense of the WebGear kit, it's the only product here that uses compression, and we were transferring an already-compressed file; its performance improved when transferring compressible files.

To test how well the products stand up to environmental factors, we took them into ZD Labs' At Home Lab, a simulated home office and family room. We also tested the products in the homes of PC Magazine reviewers.

Of the four technologies we evaluated, wireless products showed the most interference and *attenuation*, or loss of signal, thanks to devices or obstacles such as cordless phones, fish tanks, and walls. We found the wireless Diamond product to be generally the most resistant, but it relied heavily on the host's CPU. The WebGear setup was the next strongest, but it couldn't operate when a metal cabinet was placed between its two antennas. The InnoMedia kit had the same problem, coupled with painfully slow transfer times. The Proxim product had no problem with the cabinet, but performance degraded when an active microwave was in the way. Both the Diamond wireless and Proxim kits had trouble when we tested with a cordless phone that operated in the same spectrum as they did (2.4 GHz). When the phone handset was active and the base station was directly in the path of the antennas, communications between the PCs came to a virtual halt. We also used a 900-MHz phone for testing interference. Even though 900 MHz is the range that the InnoMedia and WebGear kits use, those products were unaffected.

In contrast to the wireless ones, phone-line products use a more known medium: They can share your telephone line because they transmit at a high frequency that doesn't interfere with voice communication. To test these products, we placed and received

calls during file transfers and used an analog modem. None of the tests had any adverse effect on operation.

Power-line products are often criticized because their medium, while known, is extremely *dirty*, or susceptible to interference. Simply turning on a blender may be enough to impede performance seriously, or so some claim. During our tests, we found no such problems, and performance even improved slightly when we had both a microwave and a vacuum cleaner running. We also tested with encryption on and off; that setting made no difference.

## How We Tested

We measured performance by transferring a 5.6MB executable file between a Windows 95 and a Windows 98 machine. We used a shareware tool called Automate to repeat and time the transfers.

We ran environmental testing for wireless products in ZD Labs' At Home Lab. We placed one machine in a virtual office, and the other 68 feet and four walls away. We first tested with no interference, then with a metal cabinet in the way, then with a microwave in the way, and finally with both the microwave and the cabinet. We conducted cordless telephone testing with the two machines placed approximately 5 feet apart and the phone's base station directly in between.

Power- and phone-line testing took place outside the lab, in reviewers' homes, because our lab has both conditioned power and digital phones, which can't be used in conjunction with these products. First, we tested without any interference to determine a reference timing. Then, we performed file transfers while telephone calls were in progress or appliances were in use. Each test-bed PC was a Dell OptiPlex GX1 Pentium II/400 with 128MB of RAM and a 4GB hard disk.—*Analysis written by Kevin Young*

### ▼ Among products that use

your home's existing wiring or no wires at all, the phone-line products—ActionTec ActionLink and Diamond Home Free PhoneLine—proved the fastest on our File Transfer test. The Proxim Symphony was notably faster than the competing RF kits. The InnoMedia's InfoAccess was painfully slow, which can be blamed at least in part on its serial interface (rated at only 85 Kbps).

If speed is your utmost priority,

a wired kit is clearly the way to go. The kits from NDC and Netgear employ 100-Mbps Fast Ethernet—the same as many office LANs—and completed the file transfer in only two seconds. The 3Com kit is based on older 10-Mbps technology and was slower, though still fast enough for most home users. The Anchor Chips EZ-Link uses proprietary cabling hooked to your PCs' USB ports, and delivered the same throughput as the 10-Mbps Ethernet kit.

### FILE TRANSFER (5.6MB file)

Bold type denotes first place.

denotes Editors' Choice.

|                               | Technology | Minutes:seconds |
|-------------------------------|------------|-----------------|
| <b>NO NEW WIRING REQUIRED</b> |            |                 |
| ActionTec ActionLink          | Phone line | 0:53            |
| Diamond HomeFree Phoneline    | Phone line | 0:53            |
| Diamond HomeFree Wireless     | RF         | 4:42            |
| InnoMedia InfoAccess          | RF         | 23:57           |
| Intelogis PassPort            | Power line | 6:19            |
| Proxim Symphony               | RF         | 1:52            |
| WebGear Aviator               | RF         | 6:56            |
| <b>DEDICATED WIRING</b>       |            |                 |
| Anchor Chips EZ-Link          | USB        | 0:11            |
| NDC SOHOware                  | Ethernet   | 0:02            |
| Netgear FB104                 | Ethernet   | 0:02            |
| 3Com OfficeConnect            | Ethernet   | 0:12            |

← BETTER





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## SUMMARY OF FEATURES

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## Home Networking

|                                                                        | ActionTec<br>ActionLink<br>Home Network-<br>ing Kit | Anchor<br>Chips EZ-<br>Link Instant<br>Network | Diamond<br>HomeFree<br>Phoneline                   | Diamond<br>HomeFree<br>Wireless                    | InnoMedia<br>InfoAccess             | Inteligis<br>PassPort<br>Plug-In<br>Network    | NDC SOH-<br>ware Fast<br>Ethernet<br>Network<br>Starter Kit | Netgear<br>FB104                    | PS MAGAZINE<br>EDITOR'S CHOICE<br>Proxim<br>Symphony<br>Cordless<br>ISA Card | 3Com<br>Office-<br>Connect<br>Network-<br>ing Kit<br>(4-Port) | WebGear<br>Aviator<br>Wireless<br>Network-<br>ing Kit |
|------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------|----------------------------------------------------|----------------------------------------------------|-------------------------------------|------------------------------------------------|-------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------|
| Technology                                                             | Phoneline                                           | USB                                            | Phoneline                                          | RF                                                 | RF                                  | Powerline                                      | Ethernet                                                    | Ethernet                            | RF                                                                           | Ethernet                                                      | RF                                                    |
| Street price of starter kit                                            | \$100                                               | \$90                                           | \$100                                              | \$200                                              | \$190                               | \$180                                          | \$110                                                       | \$130                               | \$150                                                                        | \$120                                                         | \$150                                                 |
| Number of PCs supported by kit                                         | 2                                                   | 2                                              | 2                                                  | 2                                                  | 2                                   | 2                                              | 2                                                           | 2                                   | 1                                                                            | 2                                                             | 2                                                     |
| Price per additional PC for add-on kits                                | \$49                                                | \$90                                           | \$50                                               | \$100                                              | N/A                                 | \$80                                           | \$30                                                        | \$30                                | \$149                                                                        | \$70                                                          | \$80                                                  |
| Maximum number of computers supported                                  | 25                                                  | 17                                             | 16                                                 | 16                                                 | 2                                   | 20                                             | 5                                                           | 4                                   | 10                                                                           | 4                                                             | 32                                                    |
| Interfaces                                                             | PCI                                                 | USB                                            | PCI                                                | ISA, PCI,<br>PC Card                               | Serial                              | Parallel                                       | PCI                                                         | PCI                                 | ISA                                                                          | ISA                                                           | Parallel,<br>USB                                      |
| Claimed data throughput                                                | 1 Mbps                                              | 4 Mbps                                         | 1 Mbps                                             | 1 Mbps                                             | 85 Kbps                             | 350 Kbps                                       | 200 Mbps                                                    | 100 Mbps                            | 1.6 Mbps                                                                     | 10 Mbps                                                       | 1 Mbps                                                |
| Works under Windows 9x/95/98                                           | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Works under Windows NT/Mac OS/Linux                                    | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Works with laptops                                                     | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Software can coexist with existing LAN software and drivers            | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Claimed maximum distance between nodes                                 | 500 feet                                            | 16 feet                                        | 500 feet                                           | 150 feet                                           | 300 feet                            | 1,000 feet                                     | None                                                        | 500 feet                            | 150 feet                                                                     | 328 feet                                                      | 125 feet                                              |
| Encryption                                                             | <input type="checkbox"/>                            | <input type="checkbox"/>                       | <input type="checkbox"/>                           | <input type="checkbox"/>                           | <input type="checkbox"/>            | <input checked="" type="checkbox"/>            | <input type="checkbox"/>                                    | <input type="checkbox"/>            | <input type="checkbox"/>                                                     | <input type="checkbox"/>                                      | <input type="checkbox"/>                              |
| Compression                                                            | <input type="checkbox"/>                            | <input type="checkbox"/>                       | <input type="checkbox"/>                           | <input type="checkbox"/>                           | <input type="checkbox"/>            | <input type="checkbox"/>                       | <input type="checkbox"/>                                    | <input type="checkbox"/>            | <input type="checkbox"/>                                                     | <input type="checkbox"/>                                      | <input type="checkbox"/>                              |
| Compliant with 802.11 protocol                                         | <input type="checkbox"/>                            | <input type="checkbox"/>                       | <input type="checkbox"/>                           | <input type="checkbox"/>                           | <input type="checkbox"/>            | <input type="checkbox"/>                       | <input type="checkbox"/>                                    | <input type="checkbox"/>            | <input type="checkbox"/>                                                     | <input checked="" type="checkbox"/>                           | <input type="checkbox"/>                              |
| Internet-sharing software included                                     | DynaNet                                             | None                                           | WinGate 3                                          | RightWare<br>WinNat                                | WinProxy                            | WinProxy                                       | None                                                        | None                                | Symphony<br>Conductor                                                        | None                                                          | WebItc                                                |
| Type of sharing                                                        | NAT                                                 | N/A                                            | Proxy                                              | NAT                                                | Proxy                               | Proxy                                          | N/A                                                         | N/A                                 | Gateway                                                                      | N/A                                                           | Proxy                                                 |
| NAT included                                                           | <input checked="" type="checkbox"/>                 | N/A                                            | <input type="checkbox"/>                           | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input type="checkbox"/>                       | N/A                                                         | N/A                                 | <input checked="" type="checkbox"/>                                          | N/A                                                           | <input checked="" type="checkbox"/>                   |
| Maximum number of computers that can simultaneously share a connection | 25                                                  | 17                                             | 3                                                  | 18                                                 | 2                                   | 6                                              | 5                                                           | 4                                   | 10                                                                           | 5                                                             | 4                                                     |
| Supports printer sharing                                               | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Supports file sharing                                                  | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Supports online gaming                                                 | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Online game software included                                          | StarControl 3                                       | None                                           | Unreal                                             | None                                               | Heretic II                          | Duke<br>Warcraft II                            | None                                                        | None                                | None                                                                         | None                                                          | None                                                  |
| Warranty                                                               | 5 years                                             | 1 year                                         | 5 years                                            | 5 years                                            | 1 Year                              | Lifetime                                       | Lifetime                                                    | Lifetime                            | 1 year                                                                       | Lifetime                                                      | 5 years                                               |
| Toll-free technical support included                                   | <input checked="" type="checkbox"/>                 | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/>                | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>            | <input checked="" type="checkbox"/>                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/>                                          | <input checked="" type="checkbox"/>                           | <input checked="" type="checkbox"/>                   |
| Live technical support hours (eastern time)                            | 11:30-8:30<br>M-F                                   | 11:00-8:00<br>M-F                              | 8:00 A.M.<br>10:00 P.M.<br>M-F, 11:00-<br>7:00 Sat | 8:00 A.M.<br>10:00 P.M.<br>M-F, 11:00-<br>7:00 Sat | 11:00-9:00<br>M-F                   | 9:00 a.m.<br>midnight M-F,<br>Noon-8:00<br>Sat | 11:30-9:30<br>M-F                                           | 24 hours<br>7 days                  | 9:00-8:30<br>M-F                                                             | 8:00-5:00<br>M-F                                              | 9:00-3:00<br>M-F                                      |

N/A—Not applicable. The product does not have this feature.

in the box pointed us to NDC's Web site for Windows 98 drivers. A simple 4-page quick-start guide is complemented by a 52-page User's Guide that explains a few networking basics, such as how to share files and printers in Windows 95. NDC's Web page has an excellent networking tutorial, which includes installation and troubleshooting tips that aren't included in the printed documentation.

Installation in our labs was complicated by a throughput problem caused by the Windows 98 driver. NDC has since written a new driver based on the problem we encountered. Once it was running, the network proved to be the fastest: It completed our 5.6MB file transfer in just 2 seconds.

The SOHware hub has five 100-Mbps ports, and one port can be used as an uplink port to another hub. Like the 3Com hub, the SOHware hub has all

the connectors on the rear panel and all the LEDs on the front. We like this arrangement for home networks, since it provides a much cleaner appearance than front-mounted connectors. Each port has two status LEDs that show link and activity status, and an additional set of four LEDs shows total network utilization.

This kit provides a good value for the money if you're familiar with Ethernet networking and you want the fastest home LAN available on the market—and you don't mind running some cable for it.—LF

## Netgear FB104

2-node Ethernet kit (expandable to 4 nodes); PCI; \$110 street. Santa Clara, CA, 888-638-4327, 408-988-2400; <http://netgear.baynetworks.com>; 514 at [www.pcmag.com/intolink](http://www.pcmag.com/intolink).



Netgear's latest home networking solution is a fast performer at an

aggressive price. Though its round-the-clock technical support will be helpful for beginners, the Netgear FB104 lacks Internet-sharing software and requires you to wade through Microsoft networking software. And like the other cabled kits here, it's a single-room-only solution, unless you're willing to run your own cable. Still, it's worth a look if fast performance is your primary requirement.

The kit includes two 10/100-Mbps PCI cards, a four-port 100-Mbps-only hub, and two 25-foot cables made of flexible, high-quality wire. Installation was slightly more complicated than with the other Ethernet products in this roundup. When we installed one of the Netgear cards in our Windows 95 test PC, the Plug and Play Manager recognized the DECchip Ethernet controller but then automatically installed a generic driver. We had to



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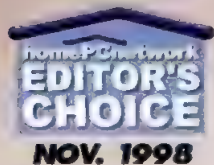
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reboot the system and manually replace the generic driver with the one provided in the Netgear kit. This process is clearly spelled out in Netgear's foldout installation guide; a second foldout sheet explains how to set up file and printer sharing in Windows 95. Curiously, although the Netgear box clearly says "Share access to the Internet," there's no Internet-sharing software in the package.

One unfortunate ergonomic choice is that the uplink switch on the hub's fourth port isn't recessed to prevent accidental operation, like those on the NDC and 3Com hubs. Still, each port does have two LEDs to show link and traffic activity, and six additional LEDs show network utilization, power, and collision status. Like most other Ethernet kits, the Netgear is fast: just 2 seconds to transfer our 5.6MB file.

Certainly a rival to the NDC offering, the Netgear kit is best for home users comfortable with networking issues. If you don't mind performing a full-blown network installation (and adding your own Internet-sharing software), either is a good choice.—LF

## Proxim Symphony

1-node 2.4-GHz RF kit (expandable to 10 nodes); ISA; \$150 street. Mountain View, CA; 800-229-1630, 650-960-1630; [www.proxim.com](http://www.proxim.com); 515 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

Granted, at \$150 per desktop, Proxim's Symphony wireless networking system costs more than the other kits here—but it's worth the investment. Its relative speed and reliability keep it ahead of the other RF-based systems we tested, and it's the only "no new wires" solution in this roundup that can effectively move a notebook from home to office, seamlessly switching the notebook's profile. The Symphony provides effective Internet sharing for all types of connections, from analog dial-up to high-speed cable and DSL. All this and unsurpassed ease of use make it our Editors' Choice.

The 2.4-GHz wireless technology provides 1.6 Mbps of throughput. Because it's wireless, it's also ideal for users who can't run cable between home PCs. The Sym-

phony's 150-foot range (300 feet outdoors) makes it possible to create a LAN that spans several stories in a multistory home or apartment building. The extensive product line includes an ISA-bus LAN adapter (\$149 list), a PC Card LAN adapter (\$199), a cordless Ethernet bridge (\$399), and an innovative cordless V.90 modem (\$299).

To create a LAN with the Symphony, you first install an adapter in each PC, then install either the cordless modem or the Ethernet bridge to provide Internet connectivity. The Symphony installs as a standard LAN driver in Windows 95; an attractive wizard walks you through the



The Proxim Symphony's software walks novices through the task of setting up shared resources, such as drives.

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hardware and software installation, a process that takes about 10 minutes per PC. The Ethernet bridge and cordless modem don't require any software installation, but you must connect one or the other before you install the LAN cards, at which point the networked machines find the modem automatically. The Symphony installs a taskbar icon that provides quick access to drive and printer mappings, a radio-signal-strength monitor, and diagnostic tools. Overall, this was the best wireless product we tested.

The Symphony's PC Card adapter lets you put your laptop computer wherever you like and still stay connected to the LAN or the Internet. The Symphony's cordless modem actually operates as a router; it connects to your ISP as needed, then disconnects automatically when no one is using the connection. As with a conventional router, several users can share access to the modem (and the Internet) at the same time.

The Ethernet bridge is a welcome new addition to the Symphony product line. It provides LAN-to-wireless connectivity

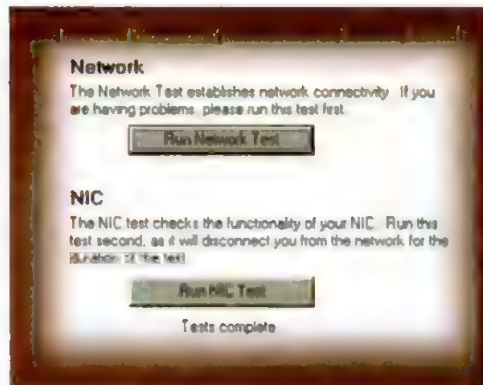
for homes and offices that already have wired LANs, and it can also be used to share a cable modem or DSL connection with all the PCs on a wireless network.

As for speed, the Symphony outpaced the other wireless offerings by a wide margin, taking less than 2 minutes for our 5.6MB file transfer. Though it is pricey, the Symphony's ease of use, reliability, flexibility, and data speeds keep it ahead of the pack among wireless network products.—LF

### 3Com OfficeConnect Networking Kit (4-Port)

2-node Ethernet kit (expandable to 4 nodes); ISA; \$120 street. Santa Clara, CA; 800-638-3266, 408-326-5000; [www.3com.com](http://www.3com.com); 516 at [www.pcmag.com/infoLink](http://www.pcmag.com/infoLink).

One of our favorite products in our previous home networking roundup ("Networks Made Easy," September 1, 1998), the 3Com OfficeConnect Networking Kit (4-Port) is starting to show its age. This 10-Mbps kit costs about the same as the 100-Mbps NDC and Netgear kits, which are both much faster. In addition,



The 3Com OfficeConnect bundle includes NIC Doctor, a useful utility for isolating problems on your LAN.

tion, like other Ethernet kits, it lacks Internet-sharing software and notebook connectivity.

The OfficeConnect kit consists of two 3Com 3C509 ISA NICs, a four-port 10-Mbps hub, and two 25-foot cables. The package includes an excellent quick-start guide and a detailed manual with helpful troubleshooting tips. The OfficeConnect works with the standard networking software built into Windows. The two bundled NICs are Plug and Play ISA cards, while NDC and Netgear provide more modern PCI cards that are easier to install.

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— BYTE Magazine, April 1998

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— Macworld Magazine,  
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On the plus side, 3Com's installation software and documentation are thorough and accessible (the quick-start guide explains how to share files and printers in Windows 95 and 98), though they don't even mention IP or the Internet.

Installation of our test NICs was uneven, working smoothly on some machines but crashing before completing the installation wizard on other Plug and Play-compatible systems. 3Com says offers a driver that fixes this problem on its Web site. In our labs, however, the new driver didn't help. We had to switch machines. 3Com's drivers include a taskbar icon that starts 3Com's diagnostic toolkit NIC Doctor, a useful feature that can help isolate problems on your LAN.

3Com's 10Base-T hub is well designed, with four ports (including one switchable uplink port) on the rear panel, and seven status LEDs on the front. As expected, in terms of speed the kit was good compared with the RF and phone-line products we tested (12 seconds to transfer our 5.6MB file) but certainly not up to its 100-Mbps competitors.

Overall, the OfficeConnect is a very basic component of a more complete line of 3Com products for home and small-office networking. It's outclassed by rival kits from NDC and Netgear, which are faster and less expensive.—*LF*

### WebGear Aviator Wireless Networking Kit

2-node RF kit (expandable to 32 nodes); parallel; \$150  
street. San Jose, CA; 877-932-4327; [www.webgear.com](http://www.webgear.com);  
517 at [www.pcmag.com/infolink](http://www.pcmag.com/infolink).

Although its parallel-port connectivity is an intriguing option for hooking up a notebook—or for users leery of opening their PCs—the WebGear Aviator Wireless Networking Kit is less successful in practice. If you need your parallel port for a printer or other device, you'll have to open the case anyway to install the included ISA-to-parallel card. On the whole, performance in our labs was slow and spotty.

The Aviator includes a manual and a set of floppy disks with network software and KansasBay Systems' WebEtc for sharing an Internet connection. The manual fully describes the installation procedure,

complete with instructions for sharing files and printers. Installing the hardware can be as simple as plugging in the cables for the network modules. If you need to add an extra parallel port, however, you'll have to open your system to install the ISA card mentioned above. And we couldn't get the card working on our test-bed; the company says it will swap the card for a jumper-based version if the Plug and Play model doesn't work.

File-transfer speed was disappointing, with our 5.6MB test file taking nearly 7 minutes. Internet access with WebEtc was intolerably slow on some but not all of the test networks we used. WebGear says the problem comes from using an external modem with particular UARTs, and it recommends using an internal modem instead. It also says this will not be a problem with the forthcoming USB version (that version will also let you reclaim your parallel port).

For now, the Aviator is best reserved for those who prefer ease of installation to performance. But it will be worth revisiting once the USB version becomes available.—*MDS PC*

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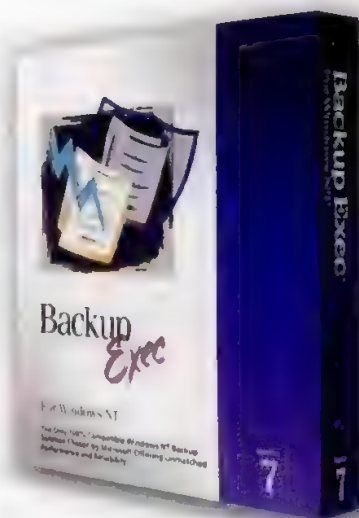
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## SOLUTIONS

## TUTOR

## Biometric Basics



*New security technologies rely on unique human traits rather than arbitrary passwords to safeguard sensitive data.*

By Neil Randall

**S**ometimes it seems as if the hackers and thieves are right behind us—or even a step ahead. We all want secure access to our sensitive documents, areas, and systems, but the inconvenience and technical limitations of traditional electronic-security measures leave us wanting more. Soon you'll have your choice of solutions.

A technology that has fascinated espionage and science fiction writers throughout most of the 20th century is biometric security. This technology makes use of the fact that each person has specific unique physical traits. While detective novels and cop shows have long made us aware that our fingerprints are unique, perhaps less known is the fact that our bodies are unique in several other measurable areas as well.

Biometrics technology uses those points of measurable uniqueness to determine our identities. The technology acts as a front end to a system that requires precise identification before it can be accessed or used. That system could be a sliding door with electronic locking mechanisms, an operating system, or an application where individual users have their own rights and permissions.

Of course, this is partly what passwords have done all along. Passwords determine identity through user knowledge: If you know the password, you can gain access to the system. The problem is that a password has nothing to do with your actual identity. Passwords can be stolen, and users can give their passwords to others, resulting in a system that is far too open to far too many people. There is simply no foolproof way to make password-protected systems completely safe from unauthorized intrusion. Nor is there any way for password-based systems to determine user identity beyond doubt.

We'll explore the basics of biometric systems, including how they work and the prevalent types. (For reviews of biometric security products, see "Are You Ready for Biometrics?" in our February 23 issue.)

#### HOW BIOMETRIC SYSTEMS WORK

Biometric systems consist of both hardware and software; the hardware captures the salient human characteristic, and the software interprets the resulting data and determines acceptability. The crucial step in building an effective biometric system is *enrollment*. During enrollment each user, beginning with the administrator who controls the system, provides samples of that system's specific biometric characteristic by interacting with the scanning hardware.

In one example, you touch a finger to a fingerprint reader or stand in front of a camera so it can capture face or eye features. The system

## USER TO USER



Replacing the logo bitmap in Microsoft Internet Explorer 4; troubleshooting a

troublesome memory module; automating repetitive e-mail tasks with the Windows 9x *Run* dialog or shortcuts; resolving IRQ and DMA assignment to install a parallel-port expansion card; referring to cells in other tables with WordPerfect 7; dealing with empty subforms in Access 97; filtering Excel tables; and more. *Page 205.*

## UTILITIES



Printing simple, unformatted text files can use up a lot of paper; PCBook2 can

help. This month's free utility lets you print up to eight pages on a single sheet of paper; and a booklet option lets you print out large booklets as sets of smaller ones. PCBook2 also supports headers, footers, word wrap, and tab expansion, and it lets you use any font on your system. *Page 214.*

## INTERNET BUILDER



XML (Extensible Markup Language), the latest tool for Web language authoring, is

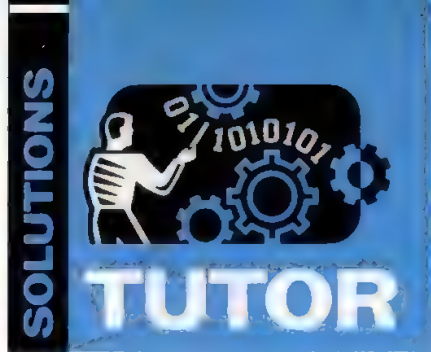
about to get better with the addition of a style mechanism: Extensible Style Language. XSL lets you mark data with author-defined elements that allow more customized and better-organized data structures than with HTML alone. *Page 217.*

## More on the Web:

You can see comparative reviews of biometric security products at [www.pcmag.com/features/biometrics](http://www.pcmag.com/features/biometrics). You'll find all of the articles, examples, and code files in this section at *PC Tech online*.

[www.pcmag.com/pcstech](http://www.pcmag.com/pcstech)





then extracts the appropriate features from the scan and stores the data as a template. You then interact with the biometric device again, and the system verifies that the data corresponds to the template. If the software fails to get a match, more tries may be needed, just as dictation software learns to recognize the user's speech patterns over time. Once this procedure is complete, the system is operational.

The next time you try to access the system, you are scanned by whatever device is being used (you might be asked to supply a user name as well), and the hardware passes the data to the software, which checks the user templates. If there is a match, you are granted access; otherwise, a message reports that the system can't identify the user. If access is granted, it is based on your profile. If you are trying to log on to a Windows 98 or NT machine, for example, the system will unlock just as if you had typed your user name and password at the log-in prompt.

#### TECHNICAL CONSIDERATIONS

The body offers uniquely recognizable features in the following areas: fingerprints, voice, eyes, hands, and face. Different vendors are developing products around each of

these features, and the jury is very much out on which technology is best. Success is measured according to a number of criteria, and each technology has both strengths and weaknesses.

The most important criteria are concerned with *accuracy*. The level of accuracy in biometric systems involves both the *false-acceptance rate* and the *false-rejection rate*. The false-acceptance rate is the percentage of users who are not authorized in the system but who are nevertheless given access. The false-rejection rate is the opposite, the percentage of authorized users who are denied access.

These rates are useful, and biometric product vendors often cite them in their product descriptions. But they don't present a complete picture. The fact is, people's physical traits change over time, especially with alterations due to accident or aging. And even in the short term, problems can occur because of humidity in the air, dirt and sweat on the user (especially with finger or hand systems), and

inconsistent ways of interfacing with the system, such as not taking enough time for the system to make an accurate identification. And users of biometric systems, like the users of all systems, must be trained to use them most efficiently.

These and other issues limit the accuracy of biometric devices. But there's little doubt that biometric systems are more accurate than other kinds of security systems, because they're based on users' actual physical characteristics, not on what they know (as with passwords) or what they're carrying (such as ID badges).

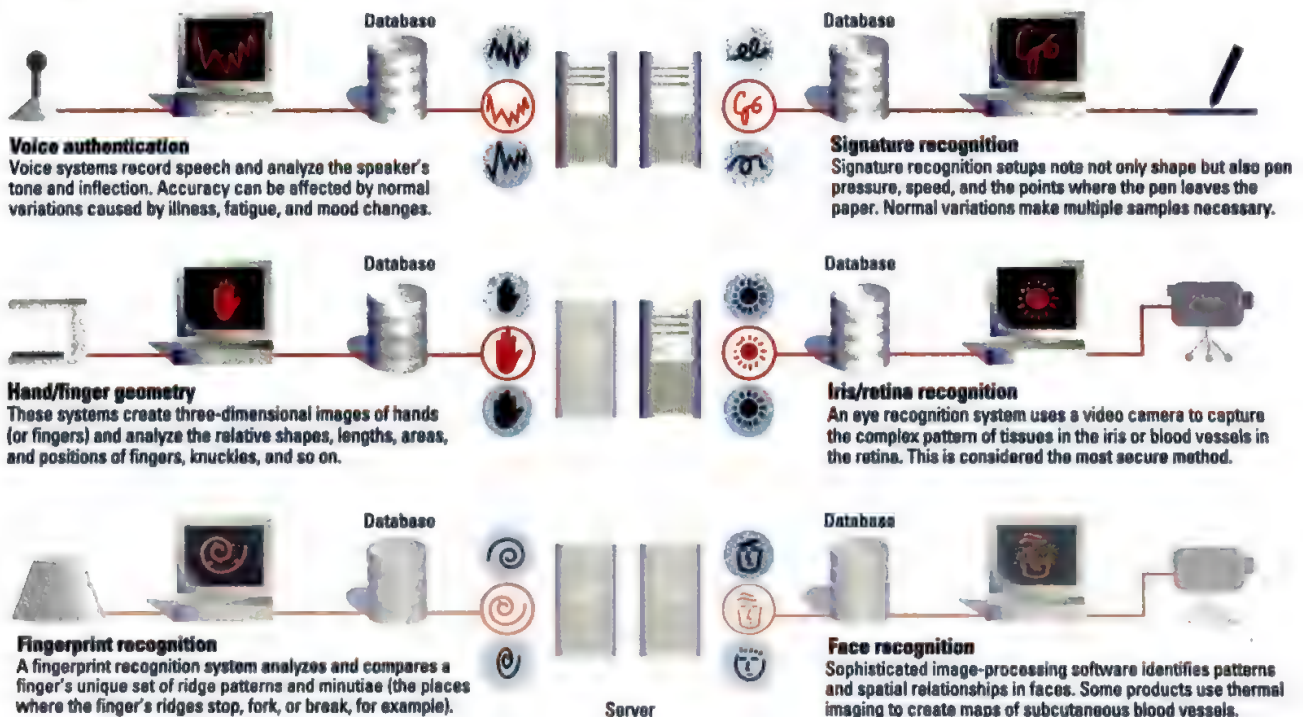
Biometrics success is also judged via a number of other factors. *Vulnerability to fraud*, also known as *barrier to attack*, reflects how likely it is that a person can fraudulently get past the security. *Long-term stability* deals with issues such as whether a system is useful for very infrequent users, as well as whether or not users' characteristics alter over time. Other effectiveness measures can include factors that might interfere with the system, ease of use, and the size of the system and the amount of disk space its data takes up.

#### TYPES OF SYSTEMS IN USE

The following systems either are available now or should be available in the near future.

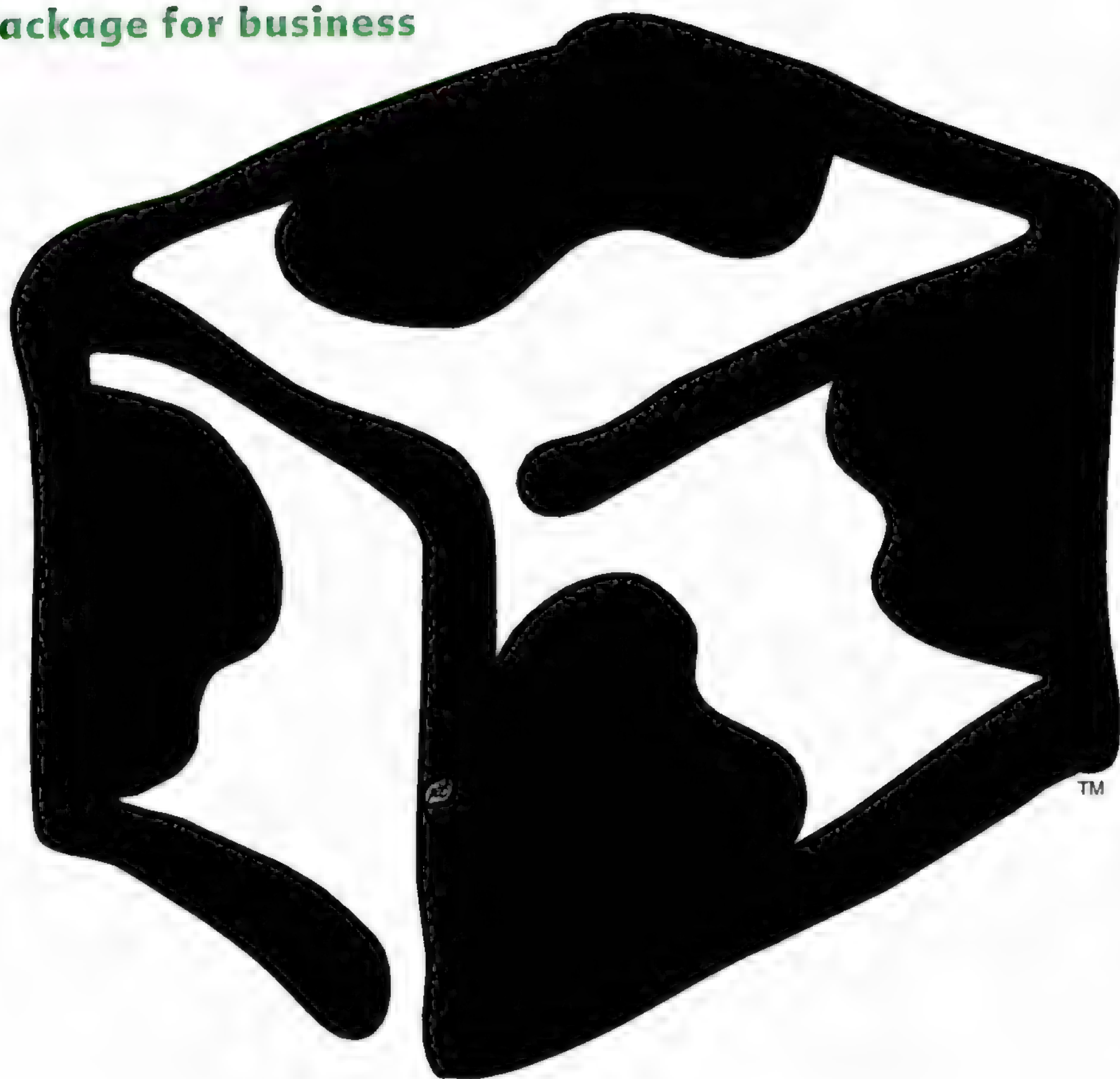
**Biometrics** Every biometric security system uses some sort of mechanical interface to gather information on the person trying to gain access. A software component then distills that information into

a set of data that can be compared with templates of users who have been previously introduced to the system. If a match is found in the database, the person's identity is confirmed and access is granted.





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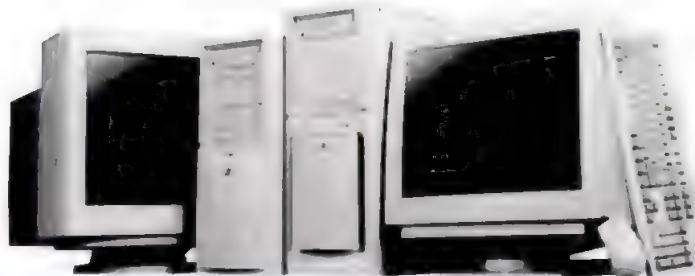
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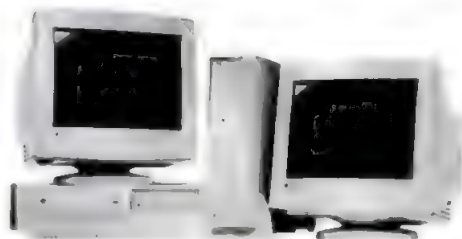
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- **Fingerprint recognition.** This system—which consists of a hardware scanner and recognition software—records specific fingerprint characteristics, saves each user's data in a template, and then refers to the templates when the user next tries to gain access. Fingerprint systems are accurate, but they can be affected by changes in the fingerprint (burns, scars, and so on) and by dirt and other factors that distort the image. (For more on fingerprint systems, see the sidebar "Fingers and Faces: A Closer Look.")

- **Face recognition.** Recognizing the shapes and positioning of the features of a person's face is a complex task, and face recognition software has only recently begun to accomplish it. First a camera captures the image of a face, and then the software extracts pattern information it can compare with user templates. (Face recognition is also treated in detail in the sidebar.)

- **Iris recognition.** The pattern of the iris (the band of tissue that surrounds the pupil of the eye) is complex, with a variety of characteristics unique in each person. An iris recognition system uses a video camera to capture the sample and software to compare the resulting data against stored templates.

- **Retina recognition.** Probably the single most secure of all, these biometric systems work with the retina, the layer of blood vessels located at the back of the eye. The retinal image is difficult to capture, and during enrollment the user must focus on a point while holding very still so the camera can perform the capture properly. The only thing that is actually determined is the pattern of the blood vessels, but since this pattern is unique in each person, identification can be precise.

The two eye-based systems, iris and retina, are generally considered to offer the best security, because of the distinctiveness of the patterns and the quality of the capture devices.

- **Hand geometry.** With this system, the user aligns a hand according to guide marks on the hand reader hardware, and the reader captures a three-dimensional image of the fingers and knuckles and stores the data in a template. Hand geometry has been around for several years, and it was used for a security

system at the 1996 Olympic games.

- **Finger geometry.** These devices are similar to hand geometry systems. The user places one or two fingers beneath a camera that captures the shapes and lengths of the areas of the finger and the knuckles. The system captures a three-dimensional image and matches the data against the stored templates to determine identity.

- **Palm recognition.** Similar to fingerprint recognition, palm biometrics focuses on the various textures, such as ridges and other minutiae, found on the palm.

- **Voice recognition.** This method captures the sound of the speaker's voice as well as the linguistic behaviors. Its primary use is in telephone-based security applications, but its accuracy can be affected by such things as extraneous noises and the effects of illness or fatigue on the voice. One obvious problem with voice recognition is fraud: The system can be fooled by a tape of someone's voice. For this reason, advanced voice systems can extend the verification process by giving the user longer and more difficult phrases to read aloud, or requesting a different phrase to be read each time. This does increase the time needed for verification,

## Fingers and Faces: A Closer Look

**F**ingerprint identification begins with the *ridge*, the raised surface of skin on a finger. Fingerprint recognition systems record these patterns of ridges in a database, then compare subsequent readings against this database to make an identification. Current fingerprint systems for the PC record several fingerprints per person.

Each fingerprint has one of three basic patterns: *loop*, *whorl*, or *arch*. In a loop pattern, the ridges start from one side of the finger, then reach the *core point* (approximately the center) of the finger and "loop" back to the same side. In a whorl pattern, some ridges form more or less concentric circles around the center of the finger, and the remainder shape themselves around these circles. The ridges in the arch pattern begin at one side of the finger and end at the other, forming a kind of arch over the center. Some fingerprints combine two or more of these basic patterns.

Just as important as the type of pattern are a print's *minutiae*, the points where the ridges stop, fork, break, or change in other ways. Minutiae can include any of the following:

- **Bifurcation:** The point where a ridge splits into multiple ridges, called branches.
- **Divergence:** The point that marks where a set of nearly parallel ridges spread apart or come together.
- **Enclosure:** Where a ridge splits into two branches and then reunites a short distance later.
- **Ending:** Where a ridge terminates.
- **Valley:** The space on either side of a ridge.

Each minutia is classified according to criteria such as its position on an x,y coordinate system, the space between the ridges at that point, the curvature of the ridges, and so forth. The entire fingerprint is the total of all its characteristics, including the pattern and all the minutiae.

### FINGERPRINT RECOGNITION TECHNOLOGY

Recognition systems capture fingerprints and record their characteristics. The images themselves are not stored. The two primary hardware technologies used in finger-imaging systems are *optical* and *capacitive*. In an optical system, the finger is placed on a glass surface, and an internal light source highlights the ridges. The capturing device typically uses a sensor based on a CCD (charge-coupled device) like those used in scanners and digital cameras.

The problem is that oil and dirt from fingers can collect on the sensing area, leaving a kind of ghost impression called a *latent image*. Over time, latent images can degrade the device's ability to capture a print accurately. Hardware makers have developed several means of dealing with this problem. One method includes keeping the most recently noted latent image in memory, then erasing the image from the scan itself so only the new print remains.

Capacitive systems use a sensor chip, an array of circuits that creates an image of the fingerprint by measuring the electrical field surrounding it. This type of system is very precise, but direct contact from users' fingers could damage the device in the long run. It is possible to combine optical and capacitive systems. One

(continues)



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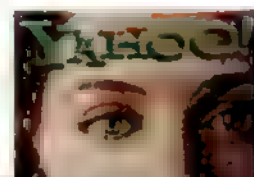
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however, and thus cuts into the system's overall usability.

• **Signature recognition.** Signature verification systems have one major thing going for them: public acceptance. On everything from the Declaration of Independence to a credit card slip, people tend to accept a person's signature as proof of identity. Actually, signature recognition systems, also called *dynamic signature verification systems*, go far beyond simply looking at the shape of a signature: They measure both the distinguishing features of the signature and the distinguishing features of the *process* of signing. These features include pen pressure, speed, and the points at which the pen is lifted from the paper. These behavioral patterns are captured through a specially designed pen or tablet (or both) and compared with a template of process patterns.

The problem is that our signatures vary significantly over time and from one instance to another, so strong accuracy requires multiple samples and an extended verification process.

These are the major biometric systems currently under development, but they're not the only ones. Researchers are developing or examining the feasibility of systems based on the analysis of DNA (currently too slow to be of real use), vein patterns, and even bodily odors.



Most solutions require you to attach external input devices to your PC—fingerprint scanners, video cameras, pen tablets, and so on. Another approach uses an external input device we all have: the keyboard. Instead of replacing the user name/password login system, this technology—called *keystroke dynamics*—works in conjunction with the login information. When you type your user name and password, the software measures your typing rhythm and compares it with your profile.

Keyboard dynamics technology measures *dwell time*, the length of time you hold down each key, as well as *flight time*, the time it takes you to move between keys. Taken over the course of several login sessions, these two metrics produce a measurement of rhythm unique to each user.

There's no technical reason why several biometric systems couldn't work in conjunction to analyze pretty much everything about us, but so far each system is claiming only one identifying pattern.

## SO WHY AREN'T THESE DEVICES ON EVERY DESKTOP?

Given current security concerns, biometric systems might seem inevitable. But in fact there remains considerable resistance to them. With issues of identity verification come the inevitable issues of individual privacy, and biometrics agencies and vendors will have to address these concerns as products come to market.

But the deciding factor, even for businesses, may be the question of whether these systems are perceived as needed. IT departments in PC-networked offices, for instance, have to consider the *actual* loss from unauthorized access, as well as the cost and complications of putting another piece of hardware on users' desks and maintaining that hardware. For home users, cost, convenience, and need are important considerations. Biometrics vendors clearly have a great deal of work to do before their systems will become ubiquitous, but it does seem fairly certain that the first decade of the next millennium will find these things cropping up in many places. **PC**

Neil Randall is a contributing editor of PC Magazine and the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage98 (Que)*.

(continued)

product uses an opaque electro-optical polymer film sensor to read the finger's electrical field and convert it into an optical image; the device then digitizes that image into data.

## FACE RECOGNITION

The face recognition process has two major parts: *detection*, locating a human face in an image and isolating it from other objects in the frame, and *recognition*, comparing the face being captured with a database of faces to find a match.

During detection, the hardware/software combination isolates the facial elements of an image and eliminates extraneous information. The software examines the image for typical facial structures (such as eyes and nose), and once it has found them, it calculates the remainder of the face. It then cuts away background details, leaving a close-up of a face inside a rectangular frame called a *binary mask*.

Recognition operates according to principles such as *eigenfaces* or *eigenfeatures*. (The German *eigen* refers in this case to the recursive mathematics used to analyze unique facial characteristics.) An eigenface-based system sees each facial image as a two-dimensional set of light and dark areas (eigenfaces) arranged in a particular pattern. The recognition algorithm stores each image as a combination of eigenfaces and then compares the eigenface characteristics of the current face with those in the database.

An eigenfeature-based system focuses on specific features such as the nose, eyes, mouth, eyebrows, and bone curvatures, and the relative distances between them. The system analyzes the

currently scanned face and extracts particular eigenfeatures, then compares these with other analyses in the database. Eigenfeature systems typically work in conjunction with eigenface systems to produce the most accurate identification possible. In general, eigenfeature systems are more accurate in identifying faces despite substantial variations such as beards and glasses.

A major difficulty for face recognition systems is that a person's face changes over time. The system must take these changes into account—not only for the face being captured but all other faces in the database as well—to make the correct identification.

All face recognition products store multiple images for each user, and they depend on a set of rules to determine identity from all the relevant data. Some products use artificial intelligence neural-network technology, in which a system effectively learns from experience. In a face recognition system, this learning process allows the system to narrow the range of facial types in the database to which it compares the current face.

Face recognition systems can and do work with only frontal facial images, but some systems offer increased security by storing both front and side views. This produces a 3-D map of the face, eliminating the security problem of imposters showing photographs of legitimate users to the camera. If the recognition system does not detect three-dimensionality, it refuses access.

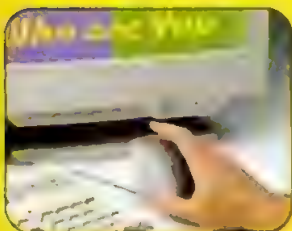
Another approach uses thermal imaging. These systems use infrared cameras to capture the pattern of blood vessels under the facial skin. These systems offer the advantage of being less susceptible to changes in the skin's surface or to the positioning of the head and can operate in darkness.



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## USER TO USER

### Replacing the IE4 Logo Bitmap

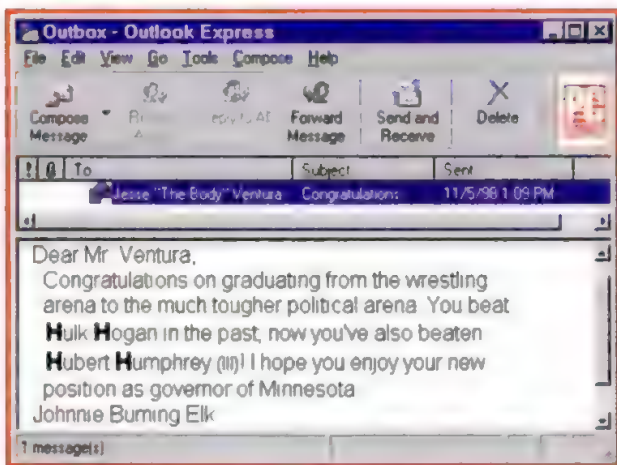
I discovered you can personalize Microsoft Internet Explorer's e-and-planet graphic in the upper-right corner by changing values in the registry. When you aren't downloading pages, this is a still image that you can replace with a 38-by-38-pixel bitmap, which you create in Paint or elsewhere. Then you launch Regedit.exe, look for the registry key HKEY\_LOCAL\_MACHINE\Software\Microsoft\Internet Explorer\Main, and change the data for the value named BigBitmap to the name and path of the bitmap you've created.

When IE is downloading pages, the graphic is animated. You can replace the animated image by creating a bitmap like a camera roll. That is, create a new bitmap that is 38 pixels in width and a multiple of 38 pixels in height. In this bitmap create 38-by-38 squares defining the frames of the animation. Using Regedit again, find the registry key HKEY\_CURRENT\_USER\Software\Microsoft\Internet Explorer\ToolBar and change the data for the value BrandBitmap to the name and path of the animation bitmap you've created. That's it!

Fernando Delgado Velez  
Guayaquil, Ecuador

**PC** As Figure 1 shows, the new bitmap appears in Outlook Express as well. You may find that the registry value BrandBitmap is not present in the specified key, in which case you must create it. Highlight the HKEY\_CURRENT\_USER\Software\Microsoft\Internet Explorer\ToolBar key in Regedit, right-click

in the right-hand pane, choose *New* from the pop-up menu, and choose *String value*. Name the new value BrandBitmap, and double-click the new value to enter the animation bitmap's full pathname. To ensure that IE4 will use your new bitmap regardless of its toolbar layout, you should also change or create the value SmBrandBitmap in the same registry key. You can specify the same bitmap here, or you can create a second animation strip in which the frames are 20 by 20



**FIGURE 1:** Here the animated logo in Outlook Express has been transformed into the PC Magazine logo.

pixels rather than 38 by 38. Your changes will take effect after you restart Windows.

The static BigBitmap value described above may affect IE4 in some way, but we didn't observe any effect. The important bitmaps are the ones specified in the BrandBitmap and SmBrandBitmap values. When busily downloading information, IE4 uses the animated bitmap strip; when inactive, it displays the first "frame" of that bitmap strip.

—Neil J. Rubenking

### Missing Memory

I tried to upgrade my computer from four 72-pin 8MB EDO SIMMs to one 168-pin 64MB

SDRAM DIMM, but my computer did nothing after displaying the message "Starting Windows 95...." It boots successfully from a floppy disk. If I remove the new DIMM and replace the old SIMMs, it boots from the hard disk again with no problem. Did I miss some installation step? Do I have to reinstall my Windows 95, or do I have to change some BIOS configuration on my motherboard?

Jim Chou  
via the Internet

**PC** This certainly sounds confusing at face value, but there's a good explanation for these symptoms, and it should be relatively easy to test.

First and foremost, it sounds as though you have done everything correctly. In general, current PCs automatically recognize installed RAM and reconfigure themselves accordingly. As a result, you probably didn't miss any installation steps.

One theory might be that there is something wrong with the specifications of the new DIMM, and that's what's causing the problem. It would certainly be worthwhile to double-check the speed and voltage requirements as specified in your motherboard documentation (or contact the manufacturer to confirm the specifications), but in general, a mismatched memory module won't work at all. The fact that your system boots partway from the hard disk with the DIMM in place—and all the way with a floppy disk—indicates that the memory is working to some degree.

The key clue in this case is that the boot from the floppy disk succeeds whereas the boot from the hard disk fails. Though you don't mention the detail in your letter, it is a reasonable assumption that the boot from the floppy disk only goes as far as the DOS prompt—as is the case with a start-up disk—whereas the hard disk boot attempts to load Windows. If this is indeed the case, then the DIMM is probably defective.

The reasoning behind this conclusion is simple. The start-up disk loads relatively little code into the system memory, and it fails to reach the flaw in the memory module. On the other hand, the full boot to Windows loads lots of virtual-mode drivers and other code into memory, which may be stalling at a point where the memory module has a failure.

Since the system successfully completes the power-on self-test (POST), you might think the DIMM is not defective, as this includes a test of the installed memory. Unfortunately, the POST memory test is nearly useless and does little more than verify that the memory is present. It does not exercise

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the memory in any significant way, and it can't be counted on to identify a failure in the memory.

As a result, the best course of action is to return the DIMM to the provider; if you can't still exchange it, take it to a local repair service that has a DIMM tester. For a nominal fee, the service should be willing to test the module and tell you whether or not it is defective.—*Alfred Poor*

## Automate Repetitive E-Mail Tasks

For the keyboard-centric and automation-maniac among us, here are a few e-mail tips that should work for most e-mail programs (Eudora, or Microsoft Outlook 97, 98, or Express, for example). In all of the following examples, "recipient" represents any valid Internet address—such as *pctech@zd.com*—or any valid Microsoft Exchange recipient—such as John Q. Public.

To create a new e-mail message without launching your parent program, bring up the *Run* dialog (<Windows key>-R), type *mailto:recipient*, and press Enter. This will open a new e-mail message, preaddressed to your designated recipient, with the cursor blinking in the *Subject* field. If you wish to address the message to multiple recipients, simply separate them with semi-colons, as in *mailto:recipient; recipient; recipient*.

To fill in the subject line in advance as well, use the following form:

```
"mailto:recipient?subject=This is the
subject of my message"
```

Note the quotation marks. These are necessary only if your subject line contains any spaces. Because it more than likely will, I have included them.

Finally, because we're filling in both the addressee and the subject in advance, why not any carbon-copies, too? Use this form:

```
"mailto:recipient?subject=This is a
test?cc=recipient"
```

You can even include some text in the main content portion of your message, although you'll probably rarely need to do so. Try the following (in combination with any or all of the preceding):

```
"mailto:recipient?body=This is the
main part of the message"
```

One final note: All of these forms may be used as the command line of a shortcut. Create a



shortcut by right-clicking in an empty region of your desktop or any folder, selecting *New*, and choosing *Shortcut*. In the resulting wizard, simply type into the command line whatever form of the above commands you require (remembering the quotation marks, if needed). Then click *Next*, give the shortcut a name, and click *Finish*. That's it. When would you ever use a shortcut like this? One example is to create a weekly progress report, sent to your boss and members of your workgroup. As you can see, all of this can be automated to a single click.

Jason Fisher  
Dallas, Texas

**PC** Besides the *cc=*, *subject=*, and *body=* message elements described above, you can also include *bcc=* to add one or more "blind carbon copy" recipients. These recipients will receive the message, but their names won't appear on it.

Unfortunately, not all e-mail packages support every combination of these elements. The original release of Outlook 97 has known problems in processing *mailto:* URLs with multiple elements. Version 8.02 fixes this problem and adds a number of other enhancements. There isn't an equivalent fix for Outlook Express yet, however. In Outlook Express, you can add any *one* of the *cc=*, *bcc=*, *subject=*, or *body=* elements, but if you attempt to add more than one it won't work. So, for example, these are all accepted by Outlook Express:

```
mailto:billg@microsoft.com?cc=billc@
whitehouse.gov
mailto:billg@microsoft.com?bcc=jimb@
netscape.com
"mailto:johnlenn@nasa.gov?subject=See
ing stars"
"mailto:dgale@usa.ks.org?body=We're
off to see the wizard"
```

But these are not acceptable:

```
mailto:jessev@usa.mn.gov?cc=huberth@aol
.com?subject=Congrats
"mailto:boss@work.com?subject=Weekly
report?body=Report for week of 02/24"
```

Other e-mail packages may have their own limits. Before attempting to create an e-mail shortcut, try the command by entering it in the *Start* menu's *Run* dialog. If it produces a cor-

rectly formatted e-mail message, create a shortcut on the desktop and copy the command from the *Run* dialog. If not, keep trying!—*Neil J. Rubenking*

## Parallel Puzzle

I recently installed a dual parallel-port expansion card in my computer. Oddly enough, port B is working fine, but port A is having problems. When I restart my computer, I get the message that there is a conflict. I know that the problem may be with either the DMA or the IRQ or both. Is there a way to find out for sure which it is without having to restart my computer a dozen more times? Are there more DMA choices than 0 to 3?

Russell Word  
via the Internet

**PC** With the proliferation of parallel-port devices, such as scanners and removable disk drives, many users have discovered that it's easier and more reliable to add another parallel port than to install two or more devices on a single parallel port. Unfortunately, adding parallel ports may tax already-strained resources in your computer, resulting in conflicts such as these.

The easiest place to start is to take out the new card and then see which IRQ and DMA assignments are already taken in your system. Right-click on *My Computer* and choose *Properties*, then choose the *Device Manager* tab. Double-click on the *Computer* icon and you'll open a *Computer Properties* window, which will list the used IRQ and DMA channels (as well as I/O port and memory assignments).

Newer computer systems provide a feature that permits IRQ sharing among devices, so don't be alarmed to see two or more assigned to the same IRQ. DMA assignments are a bit more scarce. The original IBM PC had only four available DMA channels, but since the IBM AT, systems have had seven channels. Make a note of which IRQ and DMA channels are available.

Note that your extra ports may not require DMA assignments. If you have the ports configured as Enhanced Capabilities Ports (ECPs), they will require a DMA channel, but if they are configured as Enhanced Parallel Ports (EPPs), then they will not. ECP is best suited for the highest-speed performance with printers, but EPP works well for printers and is also the best choice for most storage and scanning devices, so you may not need a DMA channel for these ports at all.

Once you know which assignments are available, you can reinstall the card and configure it to the settings you've chosen. Re-



As businesses everywhere *go global*,  
they also *go non-stop*.

After all, no matter what time it is  
in your neighborhood, it's between

*9 a.m. and 5 p.m.* somewhere.



## Non-Stop Business

[www.quantum.com/nonstopbusiness/](http://www.quantum.com/nonstopbusiness/)

# Non-Stop Business

demands reliable, around-the-clock

**S**o who watches the store when the stock market opens in Singapore, when the Sydney office must confirm a delivery schedule right now, or when a night owl in Sheboygan wants to place a catalog order this minute?

The answer, of course, is information systems. And these days, the emphasis is on information — or, more precisely, content. That's because without content, systems don't have anything to do. An organization's customers, prices, orders, e-mail — all this is data, and without it, your business and your customers' businesses grind to a ruinous halt.

## **A deluge of data**

Meanwhile, as we increasingly rely on information systems to keep business humming all the time, we're generating vast quantities of content that must be reliably stored and, often, quickly accessed by numerous people in far-flung locations.

For several years, experts have pointed to data volumes growing by at least 50% to 60% a year, thanks to electronic commerce, data warehouses and information-intensive applications focused on enterprise resources management, multimedia, e-mail and so on.

It all adds up to an enormous appetite for network-centric data storage, an appetite that, according to International Data Corporation (IDC), has been doubling annually for several years and will continue to do so for several more. By the end of this year, IDC has predicted, demand for network

data storage will approach 60,000 terabytes. In 1995, network storage needs barely topped 5,000 terabytes.

## **Dealing with data storage around-the-clock**

As volume mushrooms, keeping content both accessible and safe can be tough. It means every organization needs a comprehensive data storage strategy that meets your daily activity and backup requirements.

Today, data storage issues affect everything from network response and availability to budgets and staffing. However, increasing network complexity need not translate into management hassles. Instead, it should foster a growing partnership with a storage solutions provider whose goal is to help you manage and grow your business.

Most businesses with critically important content to store and protect look for products that:

- Support a wide range of applications with varying performance and capacity requirements,
- Deliver cost-effective fault-tolerance with RAID storage subsystems,
- Have high reliability,
- Enable installation of additional storage without putting further strain on general-purpose servers or requiring network downtime,
- Provide disaster recovery and high-performance backup solutions to fit the ever-shortening backup window.

However, selecting the right kinds of data storage products can be difficult, even risky, without expert help.



# data storage

## Get a data storage partner

The value of a data storage partner with best-of-breed products and vast experience cannot be underestimated. Just ask any organization that's suffered loss of data — and loss of revenue — because of a data storage failure.

Quantum Corporation designs and manufactures storage products for today's around-the-clock businesses. Widely recognized as the industry's quality leader and committed to being the industry's most diversified storage company, Quantum offers a variety of storage solutions ranging from the desktop to the data center.

What makes Quantum different? A commitment to consistently meeting customers' requirements in four key ways:

- **Quality.** Quantum is quality-conscious from the outset, through selection of high-reliability components and strict adherence to design margin analysis development phase. Quantum quality continues with extensive pre-production reliability testing, strategic use of automated manufacturing, long-term partnerships with high-performing suppliers and solid, consistent execution. Quantum's industry-leading product acceptance rates — in excess of 99.9% at major OEMs — is the result.
- **Use of technology.** Technology advances are occurring rapidly in the data storage industry. Quantum incorporates the newest proven technology to provide state-of-the-art products with industry standard interface options, data storage capacity and data access performance.

- **Time-to-volume production.** While introducing new technology to the world matters, ramping a product to production volume is even more important for those who will actually use it. Quantum climbs product manufacturing ramps faster than any supplier in the industry. Quantum's Fireball™ family of products ramped from zero to ten million drives in just three quarters of production, the storage industry's fastest ramp on record.

- **Ease of doing business.** Quantum delivers products that can be counted on, along with worldwide logistics capabilities, regional service delivery and dedicated customer support teams for all customers.

## Quantum: Products for all your data storage needs

What kind of data storage is best? Of course, the answer depends on the nature of your business: How important are storage-intensive applications? Do you need exceptionally fast access to them? Are reliability and data integrity of particular concern? Is data management becoming more and more difficult? What about scalability? Do you need hot swapping capability?

Quantum's broad range of products can meet all your data storage requirements.

## High-end hard disk drives

Quantum designs, develops and markets technologically advanced 3.5-inch hard disk drives for the

## Why Hewlett-Packard specifies Quantum drives in its PCs

When you've built your reputation on the reliability of your products, there's simply no room for compromise on the reliability of the components you purchase from suppliers.

That's why Hewlett-Packard Company — named #1 in reliability for personal computers by IDC and Dataquest — specifies Quantum hard disk drives for its corporate and small-business computers.

## The reliability customers demand

HP's customers have come to expect industry-leading reliability from the company's PCs. Consequently, HP's Commercial Computing Division general manager, Eric Cador, demands the same high level of reliability from his suppliers.

"For most of our customers, data is the most important part of the computer," says Cador. "If they experience loss of data, what they see is a system failure, not a hard drive failure. And that causes them to lose confidence in HP, not the supplier of the hard drive. For HP, it's an issue of customer satisfaction: that's why it is essential for us to specify reliable hard drives and other components for our PCs. Quantum offers excellent reliability at a reasonable price."

## From a dependable partner

Cador also values Quantum's dependability as a business partner. "Their supply chain initiative ensures just-in-time delivery," he explains. "They make sure our inventory is limited, getting us just the product we need when we need it."

Plus, he adds, the two companies have a good business relationship, with joint design, qualification, sales and marketing efforts.



[www.quantum.com](http://www.quantum.com)

## The difference between success and failure: Connected Corp. protects road warrior data

Today's business "road warriors" live or die based on non-stop accessibility to the information they carry in their portable computers. That's why top finance, consumer goods, energy, telecommunications, networking and software companies depend on Connected Corporation and DLTape™ technology for protecting data for road warriors, telecommuters and enterprise network users.

### Thousands of daily backups

Every day, thousands of Windows NT 4.0, Windows 95 and Windows 98 computers automatically link to Connected's Secure Data Centers, where they are backed up automatically. Data is encrypted and compressed on the PC prior to transmission to the Secure Data Centers. Hierarchical storage management (HSM) software at the Secure Data Centers transfers data from RAID disks to multi-terabyte libraries equipped with multiple high-performance DLT™ 7000 tape drives and dozens of 35 GB (uncompressed) tapes.

### DLTape drives have "best combination"

Connected rarely hears from customers about the dramatic rescues it provides, because restores are totally automatic. Whether it's a single file or a full system restore, Connected returns the user's PC to its state of operation before the mix-up. "If customers lose files, they simply recover them automatically, and we never hear about it," says Carl Lazarus, vice president of operations. "Connected chose DLTape technology because it provides the best combination of price, high capacity and fast retrieval time."

demanding storage needs of network servers, workstations, storage subsystems, and high-end desktop systems.

These 4.5GB to 36.4GB high-performance drives are designed for storage-intensive applications such as video, graphics, disk arrays, desktop publishing systems, multimedia computing systems, and networked databases and file servers.

**RAID-ready.** Quantum's Atlas™ high-capacity disk drives meet the toughest requirements of RAID subsystems, delivering the capacity, performance, and data integrity needed by the most demanding array applications and offering features that minimize an array's overall cost per megabyte. Among the best in the RAID-ready class, these drives reflect the experience of designers who trace their roots to the earliest days of disk arrays. Quantum's ASABET SCSI controller, used in Quantum Atlas, provides exceptionally low 100-ms command overhead and executes many functions in hardware to improve overall array throughput.

**Hot-swappable.** Quantum's Atlas III and Viking II Low Voltage Differential (LVD) drives are designed for use in "hot swap" applications, so users can remove potentially defective drives or upgrade capacity without the inconvenience and expense of taking down the entire system. Storage arrays and/or SCSI buses using Quantum Atlas III and Viking II disk drives will be "Hot Swap Level 4"-tolerant.

### DLTape™ systems and tape automation

Quantum designs, develops, manufactures, and markets half-inch cartridge tape systems for protecting data stored on mid-range and high-end servers. Consisting of DLTape drives and DLTape cartridge media, Quantum's DLTape system uses advanced linear recording technology

and a highly accurate tape-guide system. These half-inch cartridge tape systems protect content stored on mid-range and high-end servers, delivering the highest capacity and performance, the broadest compatible scalability, backward compatibility, and impressive reliability and data integrity.

DLTape systems have become the industry-standard platform for data protection for mid-range servers and are incorporated into products by every major computer systems vendor, as well as nearly every major tape-automation vendor. For more information please visit [www.DLTape.com/ProveIt](http://www.DLTape.com/ProveIt).

### Solid state disks

Ensuring lightning-fast access to the most important business content, Quantum's solid state disk drives deploy the high execution speeds required for such applications as on-line transaction processing, material requirements planning, scientific modeling, imaging, multimedia and video-on-demand.

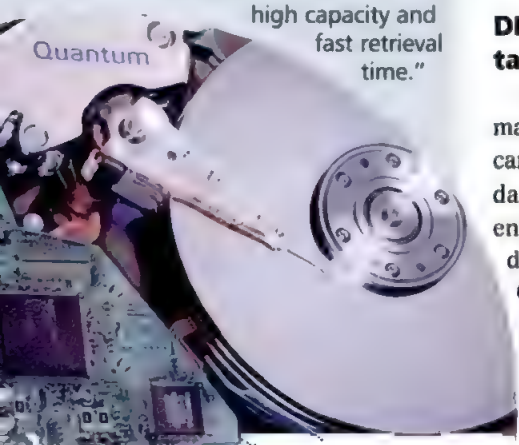
Quantum offers non-volatile and volatile solid state disks for applications — such as databases, RAID 5 configurations, the World Wide Web and sustained video streaming — requiring near-instantaneous I/O performance.

There are many ways that Quantum Corporation can help you meet your data storage needs cost-effectively without sacrificing performance, reliability or manageability.

*Come see what Quantum can do for you in today's around-the-clock business environment . . .*

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# Quantum.





boot, and then check the *Device Manager* window again to see that there are no warnings listed for any of the ports. (If there is one, you can choose *Properties* for that device and the *Properties* window will provide details about where the conflict lies.) You should soon have both extra parallel ports up and running and ready for action.  
—Alfred Poor

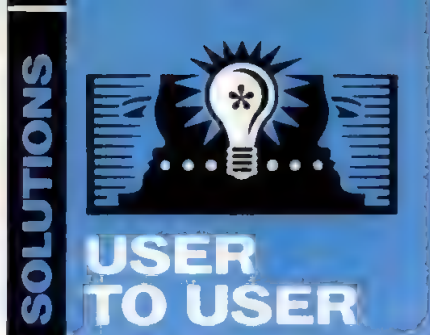
## Long Filenames and the FOR Command

I recently discovered some interesting information regarding long filename (LFN) support in Windows. As you probably know, for any directory with a long filename, you can see the MS-DOS 8.3 equivalent (usually the first six letters followed by a tilde and a number) by looking at MS-DOS name on the *General* tab of the *Properties* dialog for the directory. But did you know that if you are in such a directory in a DOS window, you can also type `TRUENAME` at the DOS prompt and this apparently undocumented command will return the MS-DOS 8.3 equivalent for the long filename?

If you write batch files and you need them

```
@ECHO OFF
:: Get the current on/off state into e-var reLFN
SET reLFN=OFF
LFNFOR | find "is on" > nul
IF NOT ERRORLEVEL 1 SET reLFN=ON
CLS
:: Switch to the TEMP directory
CD %TEMP%
%TEMP%\
:: Create some files with long filenames
REM > "This is a long filename.txt"
REM > "and so is this.txt"
REM > "and so is this as well.txt"
REM > "Here is another long filename.txt"
ECHO Without LFNFOR:
LFNFOR OFF
FOR %%v IN (*.txt) DO ECHO Filename: "%v"
ECHO.
ECHO With LFNFOR:
LFNFOR ON
FOR %%v IN (*.txt) DO ECHO Filename: "%v"
:: Clean up the mess
DEL "This is a long filename.txt"
DEL "and so is this.txt"
DEL "and so is this as well.txt"
DEL "Here is another long filename.txt"
:: Restore the previous state of LFNFOR
LFNFOR %reLFN%
```

**FIGURE 2:** This batch file demonstrates the `LFNFOR` command by listing a set of filenames with `LFNFOR` turned off and turned on.



to process long filenames accurately instead of using their diminutive aliases, then the rarely discussed `LFNFOR` command will be useful. Use `LFNFOR` with the keywords `ON` or `OFF` to enable or disable long filenames when processing the `MS-DOS FOR` command. With `LFNFOR` turned off, all filenames are processed as their 8.3 equivalents; with it turned on, their full long filenames are used. Use `LFNFOR` without a parameter to interrogate the current state of the flag.

Jason Fisher  
Dallas, Texas

**PC** The undocumented `TRUENAME` command has been present in DOS for many years now. In the past, when you passed the command a filename or directory name whose actual location was obscured by the `SUBST` command, `TRUENAME` returned the true location. `TRUENAME` is no longer useful for this purpose, because it does not retrieve the correct Version 8.3 filename. As noted here, however, you can use it to get the short pathname for the current directory. The batch file `Dolnfor.bat` (Figure 2) demonstrates the power of the `LFNFOR` command. `Dolnfor.bat` creates a few long filenames in your `Temp` directory, then processes them through the `FOR` command twice, once with `LFNFOR` off and once with it on. To finish, `Dolnfor.bat` deletes the files and restores the original state of `LFNFOR`. If you're a batch file aficionado, you'll find many uses for `LFNFOR`. However, you should restore `LFNFOR` to its original state at the end of any batch file that uses it, as existing batch files may fail with `LFNFOR` turned on.—Neil J. Rubenking

## Referring to Cells In Other Tables

WordPerfect's tables offer enough calculation capability to serve as mini-spreadsheets within a document. There are

times, however, when it would be useful to include a formula in one table that refers to cells in another table, so the calculations can be based on more than one table. Is there any way to do this in WordPerfect 7?

John Huang  
via the Internet

**PC** It's no harder to refer to cells in a different table in WordPerfect 7 than it is to refer to cells in another worksheet in a spreadsheet program. You need to know only the name of the table, the cell you want to refer to, and the right format for the formula. And the only one of these items that's at all tricky to get is the table name.

By default, WordPerfect names the first table you insert into a document Table A, the second Table B, and so on. However, because you can rename tables, delete them, copy them, move them, and so on, you can't assume that the tables in any given document are in order, or even that they still have their default names. In fact, you can't even assume that each table has a unique name, because WordPerfect will (under some conditions) copy a table name along with the table if you copy and paste a table.

The first thing you need to do, then, is to check the names of the tables, both to make sure that all the tables have unique names and to find out the names of the tables that you want to reference. Note too that if you're considering renaming any tables—so they show up in sequence, for example—you'll want to rename them before creating the formula. If you rename them later, the formula will not change automatically to reflect the new name.

To see the table names, choose *Table | Formula Bar* to add the formula bar to the top of the WordPerfect window. With the formula bar showing, any time you move the cursor to a table, its name will show in the leftmost box of the formula bar's top line. Before you move the cursor to each table in turn, however, you may want to look at all the names. Choose the *Names* button on the formula bar to open the *Table Names in Current Document* dialog box, and then examine the list on the left side of the dialog box. If you see any duplicates or want to rename the tables for any other reason, highlight the name you want to change, edit it, and choose *OK*. When you're done choose *Close* to return to your document.

Next you'll need to check the names for the tables and cells you want to reference. Move the cursor to each table in turn, and to the cell you want to reference. Note the table and cell name as shown in the formula bar.



Then go to the table that you want the formula in, and move the cursor to the cell for the formula. With the cursor in the appropriate cell, move to the formula bar by clicking on the text box to the right of the green check mark, and enter the formula including the table name. If you're entering a formula in Table C and want to add the contents of cell B3 in Table A and cell A1 in Table B, for example, the formula would be:

+Table A.B3+Table B.A1

When you finish entering the formula, hit Return or click on the green checkmark to enter the formula, calculate it, and return to the cell you started in.—*M. David Stone*

## When Subforms Have No Data

I'm a Microsoft Access 97 user who generates monthly bills for a cable TV business. I have a subscriber invoice form in which I use a subform to show some detail records and compute a balance due. The problem occurs when the subform has no data. In that instance, those controls on



my main form that reference the subform all contain #Error. How can I avoid this?

John F. Sandique  
Kidapawan City, Philippines

**PC** You have to avoid evaluating controls in the subform when the subform has no data. You can do this by placing the code in Figure 3 in your main form's On Current event. The code is called every time your main form navigates to a new record, and it's charged with determining whether the subform has any data. A global variable, fSubHasData, is set to True or False to indicate whether the subform has data. You can then test this variable in an expression in your main form to determine whether to evaluate the subform's control or not. For example, the following expression displays a value from the subform only if the subform has data, displaying 0 if it has not:

```
Public fSubHasData As Boolean

Private Sub Form_Current()
    On Error GoTo Form_CurrentErr
    Dim rstSub As Recordset

    Set rstSub = Me.Form! [Subform].Form.RecordsetClone
    On Error Resume Next          ' Ignore error on MoveFirst if empty
    rstSub.MoveFirst              ' Required to set the current row
    On Error GoTo Form_CurrentErr ' and init BOF and EOF
    If rstSub.BOF And rstSub.EOF Then
        fSubHasData = False
    Else
        fSubHasData = True
    End If
    RstSub.Close
    Set rstSub = Nothing

Form_CurrentExit:
    Exit Sub
Form_CurrentErr:
    Select Case Err
        Case Else
            MsgBox "Error#" & Err.Number & ": " & Err.Description, _
                vbOKOnly + vbCritical
    End Select
    Resume Form_CurrentExit
End Sub
```

**FIGURE 3:** Place code like this in your form's On Current event to set a global variable that indicates whether a subform contains data or not.

```
=If(fSubHasData, [Subform]![ txtSum],
0)
```

The code shown in Figure 3 first uses the RecordsetClone property to get a reference to the subform's underlying recordset. It then uses the MoveFirst method on the recordset to establish a current row and initialize the recordset's BOF and EOF properties. You must do this because a recordset established via RecordSetClone starts life with an undefined current row. The code then tests the recordset's BOF and EOF properties and sets the fSubHasData variable accordingly. The code tests both BOF and EOF because both can be True only when the recordset is indeed empty.—*Sal Ricciardi*

## Filtering Excel Tables

Each division in our company has its own set of sales reps. However, all orders are put into one Excel spreadsheet. I want to erase the rows that do not match the list of reps for my own division. The worksheet is too long to erase the entries I don't need manually. There are about 1,500 rows per month. I have a list of 45 reps I have to deal with, so the IF statement is too long. Any ideas?

Wes Crozier  
Richmond, Virginia

**PC** This is a job for Excel's Advanced Filter command. Start by listing all your own reps. You can do this on a separate worksheet, so that you don't have to repeat the task for each monthly report. Make sure that your rep list is structured the same way as the rep field in your monthly report. For example, if your monthly report has a column headed Last-Name that lists the last names of reps, then your list should also be headed LastName and should include only the last names of your own reps.

Now select any cell within the table that appears on your monthly report. Choose Filter from the Data menu and Advanced Filter from the submenu that appears. In the dialog box, the List range field should already be filled out with the range containing your monthly report data. In the Criteria range field, specify the range that contains the list of your own division's reps.

Now you can either filter the monthly report data in place (that is, hide all the rows in the original report that don't have to do with your own reps) or copy the appropriate subset of the monthly report to a new location. You make that choice by means of the option buttons at the top of the Advanced Filter dialog box. Either way, click OK and you'll get a table that includes only your own reps.—*Craig Stinson* **PC**







## Millions of pixels. Learning curve, zilch.

---

Agfa's new ePhoto® CL30 digital camera gives you clear, sharp pictures with up to 1.5 million pixels of resolution. While the new ePhoto CL50 gives you photo-quality images with over 1.9 megapixels.

And neither gives you a headache from learning how to use it. If you know how to use a traditional camera, you'll be shooting in practically no time. The software makes downloading and using pictures easy, too.

The hardest part may be choosing which one to buy. At \$399\*, the point-and-shoot ePhoto CL30 has an optical viewfinder and LCD screen. Filter and lens support. And fast downloads with USB.

The \$799\* ePhoto CL50 gives you SLR-type automatic and manual settings. Built-in flash or sync to external. 3x optical zoom. High-speed burst mode. Plus up to ten seconds of audio recording with every shot.

Try them out at your nearest dealer. And spend your time taking pictures. Instead of learning how.



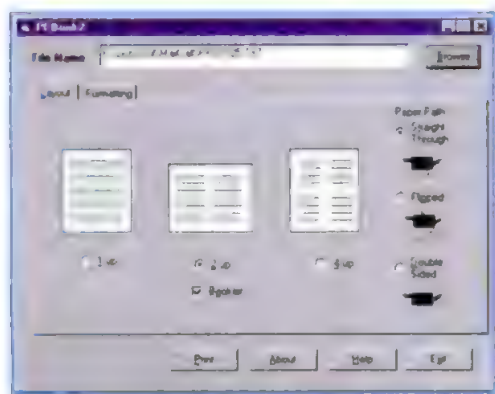
[www.agfahome.com/ephoto](http://www.agfahome.com/ephoto)

# Print Text Files as Booklets

**P**rinting text files, such as readme files or Internet standards documents, can use up a lot of paper. PCBook2 can help you save our forests. It can print up to eight pages on a single sheet of paper (four on each side). A booklet option with signatures is also available. Signatures let you print out large booklets as sets of smaller booklets. PCBook2 also supports headers, footers, word wrap, and tab expansion, and it lets you use any font on your system.

PCBook2 runs under Microsoft Windows 95, Windows 98, and Windows NT 4. An article about how to use PCBook2 and how it was written is available on our Web site at [www.pcmag.com/utilities](http://www.pcmag.com/utilities). A link for downloading the utility and its source code can also be found here.

Jay Munro, the author of PCBook2, is a senior project leader at PC Magazine. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

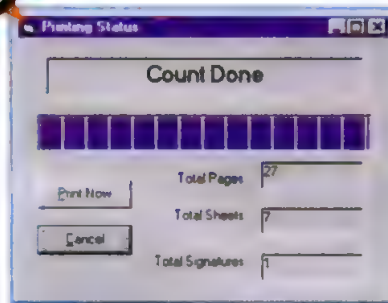
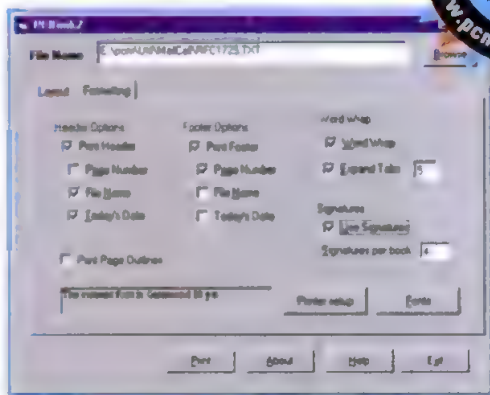


PCBook2 lets you print one, two, or four pages on a single side of a sheet of paper. When you're printing "2-up," pages can be numbered sequentially or as required for a booklet.



Click the Font button on the Formatting page to bring up the Font selection dialog box. PCBook2 lets you use any font on your system. You are not restricted to monospaced fonts, such as Courier or Letter Gothic.

The Formatting page contains numerous options, including headers, footers, page outlines, word wrap, tab expansion, and signatures (for creating large booklets as sets of smaller booklets).



PCBook2 calculates the number of pages it will print, the number of sheets of paper required, and the number of signatures.

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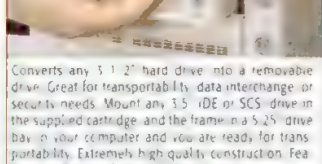
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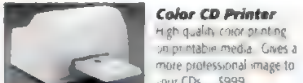
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| 32X        | Toshiba | XM6202B   | 80    | \$63 |     |
| 30X        | Pioneer | DRL944    | 70    | \$64 |     |
| 40X        | Toshiba | XM6502B   | 79    | \$73 |     |
| 40X        | NEC     | CDR3000   | 75    | \$66 |     |

### IDE CD CHANGERS

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|-------|-----------|--------|---------|-------|
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| 32X   | NEC                     | CDR1910 | 85 | \$89  |
| 32X   | Teac                    | CD532S  | 85 | \$99  |
| 32X   | Plexstor                | PX3225  | 85 | \$119 |
| 32X   | Plexstor                | PX3225  | 85 | \$159 |
| 36X   | Pioneer                 | DRL7065 | 70 | \$89  |
| 40X   | Plexstor                | PX40T5  | 85 | \$160 |
| 40X   | New! Wide SCSI Plexstor | PXTLSV  | 85 | \$189 |
| 40X   | Toshiba                 | XM6401B | 79 | \$99  |

### SCSI CD CHANGERS

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|-------|-----------|----------|------------|-------|
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# INTERNET BUILDER

## XSL: How Stylish Can You Get?

By Neil Randall

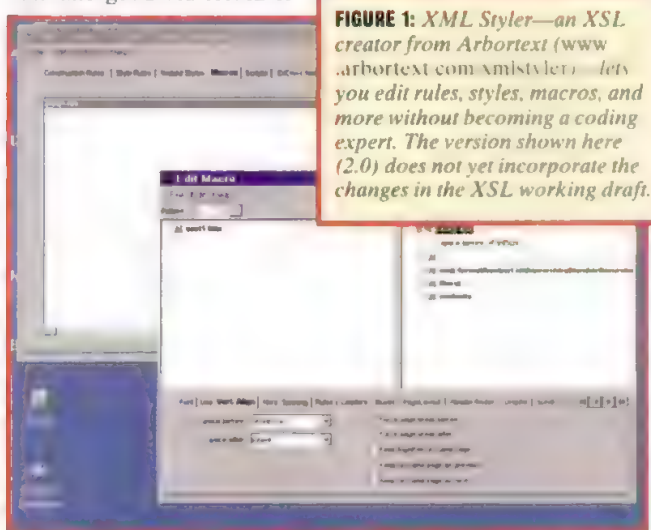
**C**ontent may be king, but style matters. The Web has clearly demonstrated that. Sure, some sites employ only the styles allowed by the basic HTML tags. But most attempt to appear unified across their stylistic elements, in the same way that all the official documents or productions of a company or organization strive for unity. For that reason, HTML has spawned the Cascading Style Sheets (CSS) mechanism, while SGML (Standard Generalized Markup Language), much earlier, added the Document Style Semantics and Specification Language (DSSSL). It's also why XML (Extensible Markup Language), the most recent addition to authoring languages for the Web, now has a style mechanism as well. Extensible Style Language, or XSL—a language for formatting XML documents and, especially, the data in XML documents—has reached the working-draft stage with the World Wide Web Consortium (W3C).

XSL has been developed because XML offers data display possibilities that go beyond HTML. XML lets authors mark up data with author-defined elements (opening and closing pairs of tags) that specify the nature of the data, with the result that the data structure is customized and more clearly organized than with HTML. But for the data inside an element to be fully understood, it must be displayed in a manner that communicates its purpose. The element must be given a style. XSL lets the author easily ensure that the data within an element or a series of elements is displayed in a certain way. The data might take on a single stylistic feature, or it might take on several.

Does XSL replace CSS? No. In fact, they work together. CSS is well suited to HTML documents, because CSS essentially layers style attributes on a full document or set of documents; XSL is best suited for documents produced from data sets, the kind XML itself excels at. The data elements can be displayed with consistent formatting in different places on one document or across a series of documents. XML can insert the datum into the appropriate location, and XSL can style it according to its function in that area.

Quite simply, XSL allows for more complex formatting than CSS. Still, the most sophisticated designs will use both for consistent page formatting with structured data formatting.

XSL and CSS can operate together, because XSL and HTML can cofunction as well. There are two essential ideas behind XSL: First, it lets you extract specific data from the XML document, and second, it lets you format that data. But if you wish, you can use XSL to extract the data and good old HTML to



**FIGURE 1: XSL Styler**—an XSL creator from ArborText ([www.arbortext.com/xmlstyler/](http://www.arbortext.com/xmlstyler/))—lets you edit rules, styles, macros, and more without becoming a coding expert. The version shown here (2.0) does not yet incorporate the changes in the XSL working draft.

style it. For instance, if you had an XML document for keeping track of home run leaders in the major leagues over the past 100 years, you might have an XML element called *team* (coded `<team></team>`) in which the name of the player's team appeared. If you wanted the team name to appear in bold italics in the final HTML document, you could tell XSL to find all instances of the *team* element and output them after applying the HTML `<b><i>` and `</i></b>` containers.

**Note:** The terminology and concepts in this article are based on the XSL 1.0 working draft ([www.w3.org/tr/wd-xsl/](http://www.w3.org/tr/wd-xsl/)). If you've worked with the earlier XSL proposal, you'll find that the working draft contains a number of significant changes. One such change is the replacement of *construction rule* with *template rule*. This has resulted in the replacement of such fundamental tags as `<rule>` as well, and in the

replacement of *action* with *template*. If you're still working with original XSL, it's important to examine the new draft.

### THE BASICS OF XSL

XSL lets authors format XML elements. It uses the syntax of XML, allowing XML specialists to style their documents and data without necessarily learning either CSS or DSSSL. The most powerful aspect of XSL is its ability to map a single data source onto multiple display targets—that is, more than one implementation of an XML or HTML document on-screen—and to style the data in each target.

XSL goes through two main steps in formatting the data. First it produces a *source tree* by matching specified *patterns* with XML elements. This tree is then processed to produce a *results tree*, based on actions specified in template rules (covered below). An XML parser

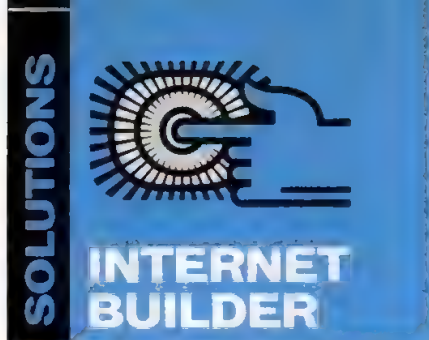
then takes the XML data and the XSL formatting instructions and transforms the results tree into an HTML document for display in a Web client. XSL is capable of data reordering,

so the results tree can look entirely different from the source tree.

In other words, you start with an XML document. In that document are elements containing data. XSL finds those elements and makes a source tree, then applies template rules to produce a results tree in which each element is assigned a specific style. Finally, the XSL processor translates the formatted elements into HTML code so that a Web browser can display it. The data comes from the XML document; the formatting, which can include restructuring, comes from the XSL stylesheet.

Actually, HTML isn't the only possible output. XSL is independent of the display language, so it's entirely possible to develop an XSL parser that translates into other types of files, such as RTF (rich text format), specific word processor formats, or even specialized formats such as Adobe's PDF. Given the move in applications such as Office 2000 to use HTML as their native document formats, however, and the fact that XML is being developed primarily for Web applications, HTML seems the most likely translation language for the foreseeable future.





## TEMPLATE RULES

The basis of XSL is the *template rule*, which establishes how the original XML element is to appear in the output document. Each template rule is made up of a *pattern* and a *template*. The pattern names the source-tree element nodes (that is, individual elements) to which the construction rule is to be applied. The template specifies what is to happen to the pattern in order to produce the relevant part of the results tree. In essence, the template rule says: Find these element nodes, then put them in this order and apply this formatting, and then put them into the results tree so they can be turned over to the parser. If you consider the XML source document the raw material and the final HTML document the finished product, then the construction rule represents the manufacturing process. Basically, these rules turn the raw data of XML into viewable information.

Patterns are strings that match the names of elements in the XML document. They specify the elements to which you want to apply the template. For example, if our XML document were an inventory of magazines, it might begin with an element called `<magazine>`, and inside we might have an element named `<magazine_type>`. If you wanted to apply styling to all data in the `<magazine_type>` element, you would tell XSL to find the pattern `magazine_type` and then apply the template to it and add it to the results tree. This basic pattern match is notated as a *match* in the *template* element, as follows:

```
<xsl:template
match="magazine_type">
</xsl:template>
```

You can tell XSL to look for a simple match, such as the element name, or you can have it match by *ancestry* in order to locate *child* elements (element names within element names) at any level. For example, the following template element

```
<xsl:template match=
"magazine_type"/
"platform"/"magazine_name">
</xsl:template>
```

would find the elements called `magazine_name` within the "platform" section of the "magazine\_type" section of the XML document.

Several other types of pattern matching are also available through XSL, but basic and ancestry are the most common.

## TEMPLATES AND FORMATTING OBJECTS

Once a pattern has been matched to its elements, the template's formatting rules come into play. The template contains instructions for formatting the data found in the patterns. As their name suggests, templates are the heart of the template rule, the part of XSL that does the majority of the work. The purpose of the template is to apply formatting, but formatting possibilities are anything but simplistic. In fact, formatting can be applied in a number of ways, including through the construction of formatting macros.

An XSL template specifies which *formatting objects* are to be applied to which patterns. Formatting objects are style items—such as font weights, text shadowing, background color, and spacing—and also formatting types, such as paragraph blocks and graphics. XSL provides a *huge* number of formatting objects, all part of its formatting vocabulary, and all of these should eventually coincide with the vocabularies of CSS and DSSSL. In fact, since one of the purposes behind the formatting-objects system is to provide XSL with the ability to output not only to the

tures as page numbers, highlighted borders, and much, much more.

The purpose of the formatting portion of the template is to create, on the results tree, objects to be formatted and then to apply the formatting to them. A created object can be one of several types, ranging from *layout objects*—which define a master style for a page or page sequence—to *math objects* for the presentation of equations (not included in the working draft) and *table objects* for the implementation of tables (also not in the working draft). The most frequently created objects, however, are *flow objects*, and their functions range from the simple creation of text blocks to the more complex specification of how flow objects are grouped together in order to apply common formatting. This latter type—the *sequence* flow object—is heavily used, because it allows the user to apply common formatting to the sequence of data within the specified named element in the XML document.

XSL templates contain instructions for actions ranging from numbering elements in a list to applying conditionals. The most common instruction, however, is `xsl:process`, used to tell XSL to apply specific formatting either to all the children of the named element (`xsl:process-children`) or only to specific children (`xsl:process`). The `xsl:process-children` instruction, in fact, is the most common XSL instruction of all.

One of the most powerful features of XSL is its ability to be highly selective about the data to which it will apply the formatting. First, the `xsl:process` select instruction lets you specify that only specific children will receive formatting. Furthermore, two conditionals, `xsl:if` and `xsl:choose`, let you be even more selective. The former looks for a pattern in XSL elements and processes instructions for any that it finds (or none, if it finds none). The latter, `xsl:choose`, is made up of one or more when statements, applying formatting to the first element it finds that corresponds to a when statement.

If it finds none, it looks for an optional *otherwise* statement and applies the instruction associated with that statement. In other words, XSL

offers limited programming as part of the template structure and, in fact, includes a macro-creation system for the more advanced programming of formatting details. Figure 1 shows an example of some programming elements available in XML Styler, an XSL creation and editing program from Arbortext.

```
<xsl:stylesheet>
<xsl:template match="/">
<fo:page-sequence font-family="arial"
font-size="16pt">
<xsl:process-children/>
</fo:page-sequence>
</xsl:template>
<xsl:template match="magazine_type">
<fo:sequence font-style="normal" font-size="12pt">
<xsl:process-children>
</fo:sequence>
</xsl:template>
<xsl:template match="magazine">
<fo:sequence font-weight="bold">
<xsl:process select="//magazine_name">
</fo:sequence>
</xsl:template>
</xsl:stylesheet>
```

FIGURE 2. An XSL stylesheet containing three template rules.

screen but also to printers, this system is the most extensive in the XSL specification. Clearly, the system anticipates formatting applications similar to (or even part of) desktop publishing packages, but until those exist, the specification will provide the necessary background for producing such formatting fea-



# A LESSON IN SHARING

6

*Great reasons to share  
your CD/DVD-ROMs*



# Six great reasons to share CD/DVD-ROMs

*on your network with AXIS StorPoint CD*

## 1 *It'll do wonders for your bottom line*

You know how valuable CD-ROM content is — databases, sales data, reference materials, parts catalogs and much more. But when these resources are stashed away on a CD-ROM on somebody's desk, they're out of reach.

When you put CD-ROMs on the network, you get a lot more use out of them.

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## 2 *You can declare independence from your file server*

The traditional way of sharing CD-ROMs on a corporate network — the file server — means s-l-o-w performance. Just as it's inefficient to share printers using an application server, your file server can be overtaxed trying to manage access to an externally-attached CD tower. If your file server goes down, your CDs go down with it. So what do you have for all that expensive software?

With AXIS StorPoint CD, you attach CD towers directly to your Ethernet or Token Ring network. So you can literally be up and running, sharing CDs and DVDs across the enterprise in a matter of minutes.



## 3 *So reliable it'll make you a hero*

The benefits of sharing CDs are clear. But choosing the right connectivity platform from the right CD-ROM tower vendor can mean the difference between smooth sailing or getting tangled in a protocol and networking jungle.

Axis provides connectivity to most of the major CD-ROM tower vendors on the market. So no matter whose Axis-based product you buy, you can be assured thousands of companies on virtually every type of network have made Axis the tried-and-true solution.

## 4 *Easy for you*

Installing an AXIS StorPoint CD-ROM tower won't take you all day. All you need is an IP address and a physical connection to your Ethernet, Fast Ethernet or Token Ring network. That's it.

Whether you're in a Novell, NT, UNIX or Intranet/Internet environment, or running TCP/IP or SMB, your CD-ROM drives are on line in just a couple of minutes.

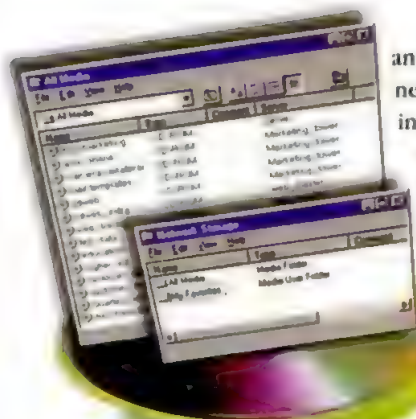
No software for any file server. No lengthy installation process. No parameters to set. It all happens automatically.

## 5 *Easy for your users*

Once your CD-ROMs are on the network, your users want to access specific CDs without hassles and without referring to a network roadmap.

Thanks to optional AXIS StorPoint DISCO client software, all CD/DVD-ROMs are only a mouseclick away. AXIS StorPoint DISCO automatically gathers





and presents all networked media in one convenient window — so your users simply point and click to open any CD, regardless of where it resides.

No more time wasted looking for CD or DVD titles on the network. No new interface to learn. AXIS StorPoint DISCO makes sharing multiple CDs across the enterprise — even hundreds of them — a breeze.

AXIS StorPoint CD is scalable with StorPoint DISCO, so your users can always find the CDs they're looking for, no matter how many reside on your network.

## 6 The backbone — ThinServer™

Axis' ThinServer Technology is the backbone of all Axis products, providing the capability to turn any CD/DVD-ROM drive into a network resource. ThinServer Technology is comprised of "thin" versions of the most popular network operating systems, Web management tools and Axis' own ETRAX 32-bit RISC processor — streamlined and optimized for device connectivity independent of any file servers.

And Axis makes sure you're always ready for new technology and new opportunities, with new product announcements, flash upgradable code and new releases that are available on the Web.



### Complete Integrator Solutions

Axis is the top-ranked manufacturer of CD and DVD-ROM connectivity for 7- and 14-bay CD-ROM tower solutions.

Using the AXIS StorPoint CD, our many integrator partners provide a variety of complete tower solutions and service levels.

For a complete listing, see our Web site at <http://ads.zdnet.com/micro/axis>

## AXIS StorPoint CD Helps Create Secure Information Availability

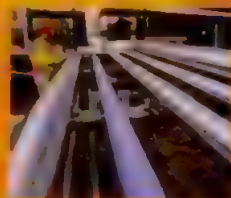
PanCanadian Petroleum's senior technology management analyst Jim Enjeneski seeks new, cost-effective ways to make information available. That's why he's become so interested in Axis Communications' StorPoint CD.

"I use AXIS StorPoint CD to distribute digital pictures and movies from my cameras," says Enjeneski. "These CDs are created on my desktop and then made accessible to anyone with a Web browser."

StorPoint's flexibility has helped Enjeneski build a new, secure information distribution capability at PanCanadian.

"I've produced temporary Web sites and placed them on a CD. StorPoint is then connected to the Internet, outside our firewall. Because CD is a nonvolatile medium, many of the security concerns of hosting a Web site have been eliminated," he notes.

"I place CDs containing conference notes on the StorPoint server and use my Netscape Compass server to index the entire CD content. So clients can search and find these CD publications."



Other uses for AXIS StorPoint CD are emerging at PanCanadian, too.

"A client can't hack into a StorPoint CD tower, so we use it to test unsecured communications services," says Enjeneski. "Testing an ATM connection or a line from our cable provider is made easier by plugging StorPoint directly into the router instead of a PC-type server or firewall. Then we can conduct basic performance and connectivity tests."

Sounds like Enjeneski and his colleagues have only just begun to find powerful ways to put the AXIS StorPoint CD to work.

# SHARES WELL WITH OTHERS

{one CD, one company, 300 employees, 6 platforms, 10 offices worldwide}



Stockholm 9:15 pm

**bob olson** –  
North American  
Sales Manager

A couple of clicks of the mouse and Bob finds the disk and pulls the sales data his boss needs. Thanks to Axis' ThinServer™ Technology, he doesn't even know the data was on a server in Stockholm. From his desktop, Bob has simple, one-point access to his company's AXIS StorPoint CD towers all over the world. Which is great, since his boss doesn't like to wait.

9:15 pm



12:35 pm

**kelli walton** –  
Marketing  
Communications  
Specialist

While Bob is doing his research, Kelli opens her "favorites" folder on her PC desktop and is instantly connected to the same disk on the same AXIS StorPoint CD tower in Stockholm. But Kelli doesn't know or care about that. She just knows she needs customer data for an ad campaign she's planning. Within seconds, she's got what she needs.

Stockholm 6:30 pm

**tony catlin** – IT Manager

Same time, different time zone. Tony gets a call at home. Somebody reported a problem getting data from the CD-ROM tower in Stockholm. But Tony doesn't have to leave home because his networked CD-ROM tower has Axis' Thin Server Technology inside. With an Internet connection and his web browser, Tony fixes the problem with his kid on his lap.

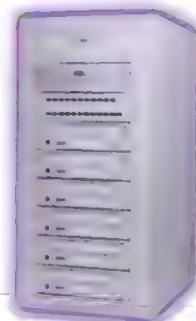
## AXIS StorPoint™ CD is the simple solution for networking CDs and DVDs.

No more looking around for CDs and DVDs. No more waiting your turn. Now with StorPoint, CD/DVD-ROMs can be shared quickly and easily by multiple users around the world or down the hall. With our new hard disk caching capability, you can find information over the network faster than ever. Our ThinServer-based AXIS StorPoint CD is now used in virtually all premier CD-ROM towers. Ask if it's inside the tower you're thinking about buying.

Learn more about AXIS StorPoint CD, our flexible caching solution, and how it simplifies the way you do business. Visit our website today. While you are there, register to win **FREE** product, and more!

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Tower solutions from  
top storage integrators  
with



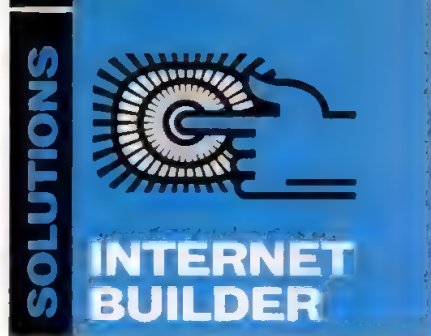
## XSL IN ACTION

How does all of this work? We can't possibly look at all of XSL here, or even at the limited number of features we've mentioned. But here are a couple of examples, geared toward readable, usable output to a Web browser.

Returning to our magazine-name example above, let's construct a template rule.

```
<xsl:template match=
"magazine_type"/
"platform"/"magazine_name">
<fo:sequence font-weight="bold">
<xsl:process-children/>
</fo:sequence>
</xsl:template>
```

This template begins the procedure of processing the children of all the `magazine_name` elements found in the XML document. Essentially, it says the following: In the document, look for elements named `magazine_name` (which are child elements of several other elements), and fetch the data associated with those elements (the names of the magazines) one at a time. As each piece of data appears, apply boldface to it. In other words, go get the first magazine name (such as, say, *PC Magazine*), make it boldface text, and do the same for all other magazine names. The result will be a list of magazine



names, all with boldface titles.

A more complex XSL example is in Figure 2. (Note that this example does not include some mandatory elements, which would appear with the opening `xsl:stylesheet` tag.)

Here we have an XSL stylesheet, as noted by the starting and ending `xsl:stylesheet` tags, which surround the elements. Inside the stylesheet are three templates, each with its own starting and ending `xsl:template` elements.

The first template commands a match on the root node (level) of the XML document. Since there's only one root node and it contains all other nodes, this means that the formatting is to be applied to everything. In this case, it's a page-sequence formatting object, with a specific font family and size; the command is to apply this formatting to all pages. In other words, it's a kind of master formatting command, but like *all* XSL template rules it will be overridden by any template that is more specific—that is, one that demands a match on *any* child of the root.

The second template rule applies a normal

font style and a 12-point font size to all data in the `magazine_type` element and to all children of that element. Note that this changes the font size of any data extracted from that element from the size specified in the first template (16 point), because the `magazine_type` element is more specific (deeper in the parent/child relationship) than the root element.

The third template is different in that it demands a pattern match on the `magazine` element, but the template is `process select` rather than `process-children`. The `//` attribute means that the formatting is to be applied to the `magazine_name` element at whatever depth it occurs beneath the `magazine` element. Since our XML document includes data beneath the `magazine` element about many types of magazines (computer, fashion, sports), this instruction will put all magazine titles in boldface. In other words, the XSL parser will locate all `magazine_name` elements and process them alike. By using `process select`, you can distinguish between the general formatting you implement with `process-children` and the specific formatting required for one element type only. In other words, you can format everything below the current node by using `process-children`, but you can use `process select` to format elements within that instruction differently from the general instruction.

## XML Namespaces

As your XML document set grows, and particularly when there is more than one author, element and attribute names may be used more than once. An element named `<title>`, for example, might easily mean different things in different documents. For an XML parser to distinguish among the conflicting elements, the XML community has developed the concept of XML namespaces.

Namespaces offer a simple, universal way to distinguish among identically named elements or attributes. The point of distinction is the URL associated with the name. Here's an example namespace declaration: `<xmlns:xsl="http://www.mycompany.com/xml/schema">`. This declaration, placed near the beginning of the document, tells the document-display software (such as IE5) that all elements beginning with `xsl` should be formatted according to the *schema* found at that URL. A schema is an XML document that specifies how tags are processed and can be referenced to reduce processing instructions in the current document.

The above example shows a default URL for all XSL elements or attributes. A more advanced use of namespaces involves specifying URLs for individual element or attribute names so you can apply different schema to different portions of the document. As an example, you could declare that the prefix `abc` refers to a schema at a specific URL, then prefix each element or attribute name with `abc` to get processing information from that URL. For example, if you declared `<xmlns:abc="http://www.yourcompany.com/formats/xml">`, and then in the body of your document, `<abc:title>King Lear</abc:title>`, you would be telling the display software to format the title according to the URL found in the prefix declaration.

The universality lies in the fact that anyone can refer to the same URL, so schemas, and thus development time, can be reused. The working draft for the XML namespaces implementation is found at [www.w3.org/tr/1999/req-xml-names-19990114](http://www.w3.org/tr/1999/req-xml-names-19990114).

## WHERE XSL STANDS TODAY

XSL—like its parent, XML—has a potentially exciting future. But XSL will take a while to settle in as a frequently used standard. We already have a style language for the Web (CSS in Versions 1 and 2), and site designers are still in the process of figuring out how best to implement it. Some sites use it, but many do not. One reason *not* to use it is that only Version 4 of IE and Navigator support it at all, and many users still have earlier versions.

Tim Bray, the primary author of the XML specifications, has emphasized these concerns at [www.xml.com/xml/pub/98/10/ie5-2.html](http://www.xml.com/xml/pub/98/10/ie5-2.html). Here he also suggests that the CSS spec be completed and that Web clients fully support all CSS1 and CSS2 features before we worry about XSL implementation. One final point is that as of this writing, the XSL specs exist only as a working draft, and the final recommendation is likely to contain a considerable number of changes. Whatever the issues, however, there seems little doubt that XSL is on its way to importance on the Web (and elsewhere in computing applications), and this is a good time to start to learn how to use it. 

Neil Randall is a contributing editor of PC Magazine and the author of *The Soul of the Internet (ITCP)*.



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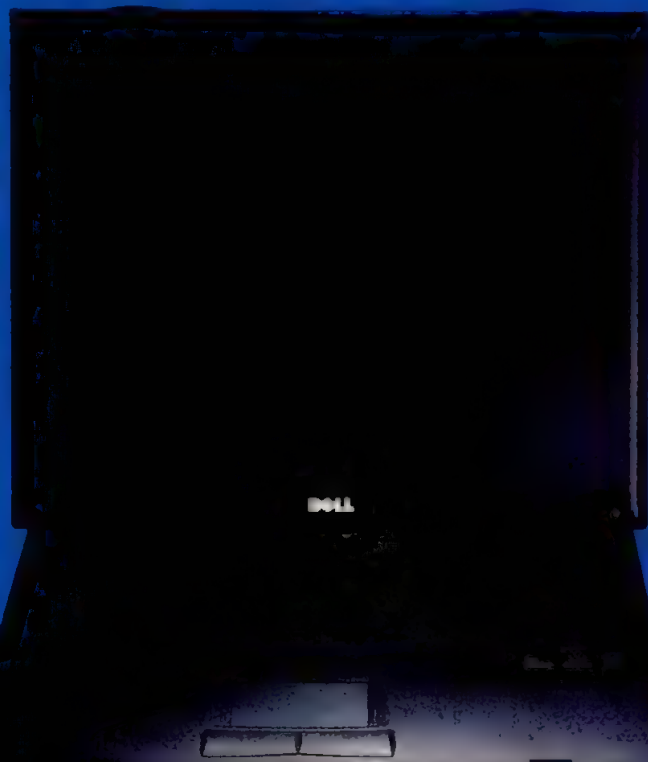
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| FAST ETHER XL PCI TX NIC (3C9058-TX)       | \$87.10  |
| FAST ENTER SERVER NIC (3C900B-TX)          | \$147.91 |
| DETANY ETHER SERVER NIC (3C9058-SX)        | \$892.01 |
| OFFICINCENT ETHER HUB 4-RJ45 (3C18704)     | \$44.95  |
| OFFICINCENT ETHER HUB 8-RJ45 (3C18702)     | \$79.23  |
| OFFICINCENT ETHER HUB 16-RJ45 (3C16702)    | \$166.98 |
| OFFICINCENT FETH HUB 4-RJ45 (3C16722)      | \$97.02  |
| OFFICINCENT FETH HUB 8-RJ45 (3C16722)      | \$177.21 |
| OFFICINCENT FETH HUB 12-RJ45 (3C16721)     | \$134.82 |
| INTEL                                      |          |
| PRO/100+ PCI NIC 10/100TX (PLA8040)        | \$61.39  |
| PRO/100+ MGMT PCI NIC NIC (PLA8141)        | \$77.22  |
| PRO/100+ SVR PCI 100BTX RJ45 NIC (MLA8470) | \$86.11  |
| INBUSINESS 8PT HUB ETHER RJ45 (SH10705S)   | \$47.92  |
| INBUSINESS 8PT HUB ETHER RJ45 (SH10705L)   | \$56.41  |
| INBUSINESS 8PT FETH HUB RJ45 (SH10704L)    | \$90.08  |
| INBUSINESS 8PT FETH HUB RJ45 (SH10705RUS)  | \$124.11 |
| NET                                        |          |
| USB NETWORK ADAPTER (USB10T)               | \$44.68  |
| ETHERFAST 10/100 NIC (LINEU10TX)           | \$24.73  |
| FASTETHERNET STARTER KIT PCI (FENSK04)     | \$113.75 |
| NETWORK STARTER KIT PCI (EWSPSC3C)         | \$55.42  |
| ETHERNET SPORT WORKGROUP HUB (EWSHUB)      | \$32.65  |
| ETHERNET 10PORT WORKGROUP HUB (EWSHUBR)    | \$49.49  |
| ETHERNET 10PORT WORKGROUP HUB (EWSHUBR)    | \$49.49  |
| ETHERFAST 10PORT 10/100 HUB (EFAH10R)      | \$242.63 |
| ETHERFAST 10/100 12PORT SWITCH (DSSX12)    | \$822.71 |
| NETGEAR                                    |          |
| 10/100 NIC PCI (FA310TX)                   | \$26.72  |
| NETWORK KIT 10MBPS PCI (SB104)             | \$79.19  |
| NETWORK KIT 10MBPS PCI (FB104)             | \$132.88 |
| ETHERNET 10PORT 10/100 HUB (EWH10R)        | \$124.72 |
| FASTETHERNET HUB 8PORT (FE10R)             | \$124.72 |
| ETHERNET SWITCH HUB (EWH10R)               | \$168.28 |
| ROUTER (RT320)                             | \$263.53 |

## PRINTERS

|                                          |           |
|------------------------------------------|-----------|
| BROTHER HL1040 10PPM (HL-1040)           | \$296.01  |
| BROTHER HL6020 6PPM 1MB (HL760)          | \$463.02  |
| BROTHER HL6020 17PPM (HL 6020)           | \$900.01  |
| BROTHER HL6030 31PPM 1MB (HL 6030)       | \$1008.01 |
| BROTHER HL6030 31PPM 1MB (HL 6030)       | \$1008.01 |
| BROTHER MFC-7200 MULTIFUNC MFC-7200      | \$290.99  |
| BROTHER MFC-8300 MULTIFUNC (MFC-8300)    | \$305.99  |
| BROTHER MFC-8500C MULTIFUNC (MFC-8500C)  | \$576.28  |
| BROTHER MFC-7770 MULTIFUNC (MFC-7770)    | \$880.81  |
| CANON BJC-260 4PPM (Q30-2260-US1)        | \$117.81  |
| CANON BJC-4300 CLP (Q30-2280-US)         | \$117.81  |
| CANON BJC-80 3PPM (Q30-2340-US)          | \$296.01  |
| CANON BJC-3000 7PPM (Q30-2600-US1)       | \$197.01  |
| CANON BJC-3000 7PPM (Q30-2600-US1)       | \$197.01  |
| EPSON STY CLR 350 (C3500118)             | SEE WEB   |
| EPSON STY CLR 1520 (C110011)             | SEE WEB   |
| EPSON STY CLR 840 14400PI (C351001)      | SEE WEB   |
| EPSON STY CLR 840 7200PI (C35001)        | SEE WEB   |
| EPSON STY CLR 840 14400PI (C35001)       | SEE WEB   |
| EPSON STY CLR 740 14400PI (C357001)      | SEE WEB   |
| HP DJ 340C (2658AABA)                    | \$874.30  |
| HP DJ 340C (2658AABA)                    | \$874.30  |
| HP DJ 850C 5PPM 800PI (C403AABA)         | \$153.30  |
| HP DJ 720C (C5870AABA)                   | \$246.01  |
| HP DJ 710C (C5864AABA)                   | \$202.74  |
| HP DJ 850C 10PPM (C4041AABA)             | \$383.05  |
| HP OFFICEJET 300 PRVFA/COPPER (C406AABA) | \$308.45  |
| HP COLOR COPIER 140 (C5372AABA)          | \$622.47  |
| HP L 5 12PPM 4MB (C3184AABA)             | \$415.82  |
| HP L 5 12PPM 4MB (C3184AABA)             | \$415.82  |
| HP L 5000 16PPM 4MB (C4110AABA)          | \$1433.52 |
| HP L 4000 17PPM 4MB (C4110AABA)          | \$1106.75 |
| HP L 1120CXL 2LR 2MB (C2680AABA)         | \$482.13  |
| HP L 8PP 6PPM 2MB (C326AABA)             | \$880.01  |
| HP L 6PP 16PPM 2MB (C421AABA)            | \$751.43  |
| HP L 1100C 8PPM 2MB (C4205AABA)          | \$304.90  |
| LEXMARK 5750 CLR JP (970001 17A0000)     | \$228.71  |
| LEXMARK 5770 CLR PHOTO JP (A0555)        | \$334.31  |
| LEXMARK 1070 CLR JP (970001 17A0000)     | \$228.71  |
| LEXMARK 1100 CLR JP 3.5PPM (17Z0050)     | \$108.20  |
| LEXMARK 4075 PLUS CLR (4070000)          | \$1391.94 |
| LEXMARK OPTRA E- 6PPM 2MB (11A7530)      | \$326.68  |
| LEXMARK OPTRA SC1275 (11C0021)           | \$2474.01 |
| OKI ORIPAGE BW 600PI 8PPM (OKI13781)     | \$246.81  |
| OKI ORIPAGE BW 600PI 8PPM (OKI13781)     | \$246.81  |
| OKI ORIPAGE 300 20PPM (OKI13204)         | \$989.01  |
| OKI ORIPAGE 100R 19PPM (OKI13001)        | \$305.01  |
| NEC SUPERSCRIPT 1260 17PPM 2MB (1760)    | \$601.33  |
| NEC SILKWRITE 1760 17PPM 4MB (1770)      | \$650.41  |
| NEC SUPERSCRIPT 4400 CLR 4PPM (4400)     | \$2474.01 |
| NEC SUPERSCRIPT 870 8PPM 4MB (870)       | \$516.77  |
| RENDER DR P17 8PPM 16MB (P17ALP001)      | \$344.52  |
| RENDER DR P17 8PPM 16MB (P17ALP001)      | \$344.52  |
| XEROX DP M17 17PPM 16MB (XAL00017)       | \$1280.01 |

## STORAGE

| MAXTOR                    |          |
|---------------------------|----------|
| 8 40GB UDMA HD (DM840D0)  | \$147.91 |
| 8 40GB UDMA HD (RM840C4)  | \$177.07 |
| 13.6GB UDMA HD (91360D8)  | \$254.33 |
| 17.2GB UDMA HD (91728D8)  | \$324.89 |
| SEAGATE                   |          |
| 6.5GB UDMA HD (ST36531A)  | \$151.18 |
| 8.5GB UDMA HD (ST36641A)  | \$171.33 |
| 9.2GB UDMA HD (ST37161A)  | \$197.10 |
| 4.5GB SCSI HD (ST33450V)  | \$464.18 |
| 6.5GB SCSI HD (ST33630WC) | \$262.57 |
| 9 1GB SCSI HD (ST19101N)  | \$821.64 |
| WESTERN DIGITAL           |          |

C38400

|                                        |          |
|----------------------------------------|----------|
| 10.1GB UDMA HD (AC310100)              | \$211.96 |
| 13GB UDMA HD (AC310000)                | \$246.51 |
| 4.3GB SCSI (E4360-0003)                | \$368.31 |
| 9.1GB SCSI (E9100-0008)                | \$470.62 |
| <b>IDE/EGA</b>                         |          |
| ZIP 550MB ZIP EXT SCSI (10013)         | \$187.01 |
| ZIP 100MB ZIP USB (11030)              | \$147.51 |
| ZIP/FLOPPY 100MB PARV/SCSI EXT (10000) | \$143.12 |
| ZIP 100MB ATAPI INT (10670)            | \$90.01  |
| ZIP 100MB PARV/SCSI EXT (10032)        | \$117.81 |
| ZIP 100MB TOSHIBA SLIM BAY (1017)      | \$171.01 |
| ZIP 100MB COMPAQ ARMADA 7700 (11018)   | \$197.01 |
| ZIP 100MB COMPAQ ARMADA 7800 (11018)   | \$197.01 |
| ZIP 100MB IBM THINKPAD 770 (11020)     | \$197.01 |
| CLIK DRIVE DIGITAL CAMERAS (10000)     | \$197.01 |
| CLIK DRIVE DIGITAL CAMERAS (13251)     | \$197.01 |
| CLIK DRIVE PULPS (13252)               | \$296.01 |
| JAG ZGB INT SCSI DRIVE (13040)         | \$345.51 |
| JAG ZGB EXT SCSI DRIVE (13047)         | \$345.51 |
| DITTO ZGB EXT PAR TAPE (10333)         | \$171.81 |
| DITTO ZGB INT (10334)                  | \$171.81 |
| DITTO MAX ZGB INT (10680)              | \$197.01 |

## CD-WRITER

|                                              |          |
|----------------------------------------------|----------|
| HP COWITER PLUS 7200 INT EIDE (C4385AAB6)    | \$296.11 |
| HP COWITER PLUS 7200 EXT/PR EIDE (C4385AAB6) | \$375.21 |
| HP COWITER PLUS 8100I INT EIDE (C4385AAB6)   | \$323.21 |
| H-VIAL 2X2X2 IDE INT CD-RW (H2242A-COR)      | \$304.82 |
| MICROSOFT BACKUP 2000 EXT (M0125)            | \$474.21 |
| MITEMIX 4X IDE CDR (CN-4801TE)               | \$232.17 |
| PHILIPS CORW 2X8X INT EIDE (C33A00RW)        | \$296.10 |
| RICOM CORW 8X24X2 EXT EIDE (C33A00RW)        | \$296.01 |
| RICOM CORW 4X42X2X INT EIDE (C332700)        | \$395.01 |
| SMART FRINDLY 226 INT 2X2X8X (SAF75)         | \$424.71 |
| SONY CORW 4X INT EIDE (C4010000)             | \$268.80 |
| YAMAHA CORW 16X2X INT EIDE (C9W2216E)        | \$296.80 |

## DIGITAL CAMERAS

|                                          |           |
|------------------------------------------|-----------|
| AGFA EPHOTO 78 (EPHOTO7805K12)           | \$271.95  |
| AGFA EPHOTO 386 (EPHOTO386)              | \$363.00  |
| AGFA EPHOTO 1660 (EPHOTO1660N3C)         | \$688.00  |
| CANON AE PRIMER 35 (AE-PR35-1007-135)    | \$100.00  |
| CANON QV7000 (QV7000)                    | \$1000.00 |
| CANON QV770 440 (QV770)                  | \$304.12  |
| CREATIVE BV WEBCAM II PAPPT (5000001048) | \$81.60   |
| CREATIVE BV WEBCAM II USB (5000001070)   | \$81.60   |
| EPSON PHOTOPC 700 CLR AB (80730113)      | SEE WEB   |
| FLIM DX-2 ZOOM (43855130)                | \$469.00  |
| FLIM MAX-500 (MAX-500)                   | \$429.00  |
| KODAK DC220 CLR AB (1930474)             | \$692.00  |
| KODAK DV323 CLR VDCAM USB (8022988)      | \$1187.33 |
| KODAK DC210 PLUS (8208795)               | \$484.00  |
| KODAK DC200 (8029336)                    | \$386.00  |
| KODAK DC200 8MB (8081798)                | \$374.00  |
| KODAK DC190 (8543349)                    | \$440.00  |
| MINOLTA DIMAGE IV (2755-306)             | \$365.33  |
| MINOLTA DIMAGE EX ZOOM 1500 (2780303)    | \$847.44  |
| MINOLTA MAXXUM 400 (8635-107)            | \$373.44  |
| MINOLTA SHAPRY VDCAP VPSI (31-0300)      | \$87.65   |
| NICOM D-300 3MB (25531)                  | \$255.00  |
| NICOM COOL PAPER 600 8MB (25501)         | \$255.00  |
| NICOM COOL PAPER 8025 8MB (25542)        | \$720.07  |
| OLYMPUS D-300R (225505)                  | \$464.00  |
| OLYMPUS D-400Z ZOOM (225503)             | \$701.00  |
| OLYMPUS D-400Z ZOOM (225509)             | \$701.00  |
| OLYMPUS D-400Z ZOOM (250506)             | \$1187.00 |
| PANASONIC D-400Z ZOOM (250506)           | \$1187.00 |
| PHILIPS US PC CAMERA (PCAN500)           | \$24.14   |
| NICOM RDC4002 2MB (776190)               | \$385.00  |
| NICOM RDC400 4MB (776210)                | \$464.00  |
| NICOM RDC400 8MB (776200)                | \$580.00  |
| SONY MVC-F01 1MAYICA (MVC-F01S)          | \$434.00  |
| SONY MVC-F01 1MAYICA (MVC-F01L)          | \$434.00  |
| SONY MVC-F01 1MAYICA (MVC-F01H)          | \$771.00  |
| SONY MVC-F01 1MAYICA (MVC-F01H)          | \$980.00  |
| SONY DSC-D700 P/PWR (DSC-D700)           | \$1743.30 |
| TOSHIBA FOR-RS (FOR-RS)                  | \$345.95  |
| TOSHIBA FOR-R1 (FOR-R1)                  | \$644.65  |
| SIMPLE COMPACTFLASH 1MB (STI-CF16)       | \$37.70   |
| SIMPLE COMPACTFLASH 16MB (STI-CF16)      | \$44.00   |
| SIMPLE COMPACTFLASH 24MB (STI-CF24)      | \$44.44   |
| SIMPLE COMPACTFLASH 32MB (STI-CF32)      | \$56.56   |
| SIMPLE COMPACTFLASH 48MB (STI-CF48)      | \$123.34  |
| SIMPLE SMARTMEDIA 2MB 3V (STI-SM2S)      | \$19.00   |
| SIMPLE SMARTMEDIA 8MB 3V (STI-SM8S)      | \$19.00   |
| SIMPLE SMARTMEDIA 16MB 3V (STI-SM16S)    | \$25.44   |
| SIMPLE SMARTMEDIA 16MB 3V (STI-SM16H)    | \$51.11   |
| SIMPLE SMARTMEDIA 25MB 2V (STI-SM2S)     | \$19.00   |
| SIMPLE SMARTMEDIA 4MB 5V (STI-SM4S)      | \$19.44   |
| SIMPLE MINIATURE CARO 2MB (STI-MCFL2)    | \$37.70   |
| SIMPLE MINIATURE CARO 8MB (STI-MCFL8)    | \$44.00   |
| SIMPLE MINIATURE CARO 16MB (STI-MCFL16)  | \$106.67  |
| SIMPLE MINIATURE CARO 32MB (STI-MCFL32)  | SEE WEB   |

## SOFTWARE

|                                            |           |
|--------------------------------------------|-----------|
| NATURALLY SPEAKING VS (21-034-82-01)       | \$1748.55 |
| INTUIT CUCKER DELUXE BW (015800)           | \$58.49   |
| INTELLIGENT MAIL 2000 (000002)             | \$100.00  |
| MICROSOFT FRONTPAGE BW (SFG-02096)         | \$129.73  |
| MICROSOFT OFFICE2PRO (P0623-00014)         | \$306.62  |
| SYMANTEC ANTIVIRUS VS (07-00-02307)        | \$368.61  |
| SYMANTEC WINVAX PRO 9 (12-00-02541)        | \$106.98  |
| SYMANTEC ACT & R. WINVISED (H8-00-026)     | \$168.33  |
| SYMANTEC ACT & R. WINVISED (H8-00-026)     | \$168.33  |
| SYMANTEC PCANYWHERE REM (07-00-02104)      | \$101.93  |
| SYMANTEC PCANYWHERE HOST07 (07-02-0106)    | \$185.54  |
| SYMANTEC PCANYWHERE HOSTREM (07-00-02077)  | \$141.50  |
| SYMANTEC PCANYWHERE C REM07 (00-02013)     | \$368.61  |
| MICROSOFT OFFICENT STD UPD (01-00709)      | \$218.61  |
| MICROSOFT OFFICENT STD UPD (01-00709)      | \$218.61  |
| MICROSOFT WINLET SERVER 4.0 (22-007-0125)  | \$672.21  |
| MICROSOFT WINLET WXPST 4.0 LFG (23-005M11) | \$972.71  |

## MULTIMEDIA

|                                              |          |
|----------------------------------------------|----------|
| CREATIVE SB LIVE! VALUE PCI (3040/201000)    | \$98.00  |
| CREATIVE SB LIVE! PCI (8046201000)           | \$187.11 |
| CREATIVE SB PCI28 PCI (2008201000)           | \$98.31  |
| CREATIVE PC-DVD 5X ENCORE KIT (5071221002)   | \$510.42 |
| CREATIVE PC-DVD 2X WITH DXR2 (5071201000)    | \$326.79 |
| CREATIVE DSKTP THEATR 5.1 SPKRS (1100001454) | \$296.01 |
| CREATIVE MICROWORKS SPKRS (11000011298)      | \$232.74 |
| DIAMONDMM MONSTERSHD M3000 PCI (600110041)   | \$91.08  |

## POWER PROTECTION

|                                               |           |
|-----------------------------------------------|-----------|
| APC BACKUPS OFFICE 150 (BP150)                | \$84.00   |
| APC BACKUPS OFFICE 200 (BP200)                | \$104.00  |
| APC BACKUPS 600 (BP600)                       | \$144.00  |
| APC BACKUPS PRO 350 (BP350U)                  | \$187.11  |
| APC NETWORK SURGEARREST (NETTT)               | \$47.11   |
| APC PRO SURGEARREST (PROT)                    | \$26.72   |
| APC PRO SURGEARREST (PERT)                    | \$26.72   |
| APC MATRIX UPS (MX3000)                       | \$284.00  |
| APC SMART-UPS 700NET (SU700NET)               | \$334.47  |
| APC SMART-UPS 1400NET (SU1400NET)             | \$399.00  |
| TRIPLITE INTERNET OFFICE 260 (InternetOffice) | \$187.00  |
| TRIPLITE SUPER SURGE 800 (SUPER800)           | \$155.25  |
| TRIPLITE DC/PC 800 (DC/PC800)                 | \$155.25  |
| TRIPLITE SUPER SURGE ALERT (TR6)              | \$29.30   |
| TRIPLITE SUPER SURGE (SNGR-6)                 | \$20.50   |
| TRIPLITE SPK5 STK (STW)                       | \$11.00   |
| TRIPLITE SMARTPRO NET-UPS (SMART700NET)       | \$279.00  |
| TRIPLITE SMARTPRO NET-UPS (SMART1400NET)      | \$329.00  |
| TRIPLITE SMARTPRO NET-UPS (SMART1400NET)      | \$327.13  |
| TRIPLITE SMARTPRO NET-UPS (SMART2000NET)      | \$377.46  |
| TRIPLITE SMARTPRO NET-UPS (SMART3000NET)      | \$1126.00 |
| TRIPLITE OMNISMART UPS (OMNISMART650VMP)      | \$228.00  |

**PDA**

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## CANN

|                                             |               |
|---------------------------------------------|---------------|
| APDA SPINSM 1212U USB (500x211x210PC)       | \$124         |
| EPSON EXPRESS 636 (636 PNCPT2UP)            | <b>SEE WE</b> |
| EPSON EXPRESSION 836X (836X, PC)            | <b>SEE WE</b> |
| HP SCANJET 5100CX (C5193AAABA)              | \$109         |
| HP SCANJET 6200CX (C6273AAABA)              | \$139         |
| HP SCANJET 7400 (74003AAABA)                | \$149         |
| HP SCANJET 4100 (41003AAABA)                | \$149         |
| MINICROTEK SCANAMKR 16 (1108 03172020)      | \$149         |
| MINICROTEK SCANAMKR 16 USB (1108 031410705) | \$149         |
| MINICROTEK SCANAMKR 8600XL (1108 03036020)  | \$139         |
| MINICROTEK SCANAMKR 6400XL (1108 031360110) | \$139         |
| MINICROTEK SCANAMKR 4368T (1108 03420020)   | \$139         |
| MINICROTEK SLIMSUN 68 (1108 031460002)      | \$139         |
| SEIKO SCANER 1200 (1200 03036020)           | \$139         |
| UMAX POWERLOCK II (SPRGK120)                | \$149         |
| UMAX ASTRA 1200 DLX (SPRGK13420)            | \$149         |
| UMAX ASTRA 810S DLX (SPRGK13406)            | \$149         |
| UMAX ASTRA 1200U (SPRGK13410)               | \$149         |
| UMAX ASTRA 1220U USB (SPRGK13423)           | \$149         |
| UMAX ASTRA 2400S (SPRGK13430)               | \$149         |
| UMAX ASTRA 2400S TCM (5500 W 7500 W)        | \$179         |
| VISIONER PAPPET 6100 (PC-6100) W/B          | \$149         |

## VIDEO CARDS

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## MONITORING

|                                                |        |
|------------------------------------------------|--------|
| ARGON 15IN 28MM (T554)                         | \$178  |
| ARGON 17IN 27MM (T770)                         | \$219  |
| ARGON 17IN 25MM (T775)                         | \$214  |
| ARGON 17IN 21MM (T782)                         | \$213  |
| ARGON 17IN 21MM (T787)                         | \$213  |
| ARGON 15IN LCD (TP15)                          | \$201  |
| NEC MULTISYNC 150V 15IN LCD (LA-1522JMW)       | \$3067 |
| NEC MULTISYNC LCD2010 10 18IN LCD (LA-2032JMW) | \$4798 |
| NEC MULTISYNC LCD1810 10 18IN LCD (LA-1831JMW) | \$3464 |
| NEBU DUAL SCAN 70 17IN 28MM (D570)             | \$195  |
| NEBU DUAL SCAN 70 17IN 25MM (D585)             | \$195  |
| NEBU DIAMOND PLUS 10E 21IN 26MM (CPULS100E)    | \$3087 |
| MAQ XJB10 19IN 26MM (XJB10)                    | \$484  |
| MAQ DQ20 19IN 26MM (DQ20)                      | \$827  |
| MULTISYNC A700+ 17IN 28MM (LCD-1730VMM)        | \$398  |
| NEC MULTISYNC A900 18IN 28MM (LCD-1840JMW)     | \$585  |
| PRINCETON ED705 17IN 27MM (ED705)              | \$378  |
| POTTER DUAL SCAN 17IN 27MM 16:9 (E771-9)       | \$444  |
| SONY MULTISCAN L150 LCD (CPD-L150)             | \$313  |
| SONY 2005S 17IN 28MM (CPD-2005S)               | \$346  |
| SONY 2005S 19IN 28MM (CPD-2005S)               | \$822  |
| SONY 520G5 21IN 26MM (CPD-520G5)               | \$1008 |
| VIEWEG V17 17IN 26MM (V73)                     | \$338  |
| VIEWEG V15 19IN 25MM (V50)                     | \$378  |
| VIEWEG V17 17IN 27MM 16:9 (E771-9)             | \$378  |
| VIEWEG V1710 17IN 28MM (CPD-V1710)             | \$664  |
| VIEWEG V1910 19IN 28MM (CPD-V1910)             | \$673  |
| VIEWEG V1915 15IN LCD (VPA150)                 | \$1116 |
| VIEWEG VGI180 18IN LCD (VG180)                 | \$2720 |
| VIEWEG VPD150 15IN QD LCD (VPD150)             | \$1088 |
| <b>PC CARDS</b>                                |        |
| SCOM MIGHT 06K QLC DIMM (SCCA1560-US)          | \$197  |
| SCOM MIGHT 8K RAM (SCCA1560)                   | \$192  |
| SCOM MIGHT 8K RAM (SCCA1560)                   | \$192  |
| SCOM MIGHT 8K RAM (REMAK8150-108T)             | \$184  |
| XINCOM RLPT LK LK ONLY (RE-1008TX)             | \$136  |
| XINCOM RLPT RK RAM MODE (RA56V1)               | \$136  |

## MODE

|                                           |        |
|-------------------------------------------|--------|
| 3COM USB 56K V90 WINMODE (005083-0)       | \$78.  |
| 3COM USB 56K V90 FAXMODE INT (00MM7-0)    | \$122. |
| 3COM USB 56K V90 FAXMODE EXT (005086)     | \$145. |
| 3COM USB 56K V90 VOICE INT (005085-0)     | \$126. |
| DM9000 SUPHAX 56K PCI (SMBSPC-XL1)        | \$49.  |
| DM9000 SUPRAEXP 56K V80 INT (XP866PCXL1S) | \$86.  |
| DM9000 SUPRAEXP 56K V80 EXT (XP866PCXL1S) | \$107. |
| DM9000 SUPRASONIC 112K V90 INT (S52J-RET) | \$137. |



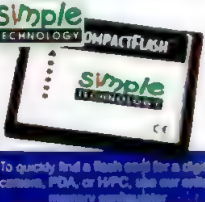
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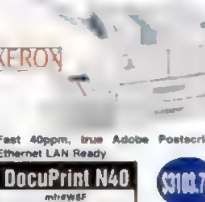
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| <b>Tecra Series</b>     |          |                   |     |           |           |           |       |         |
| #43475                  | 8000     | 366 PII MMX       | 64  | 8.1GB 24X | 13.3" TFT | —         | —     | \$3,899 |
| #43474                  | 8000     | 366 PII MMX       | 128 | 8.1GB DVD | 14.1" TFT | —         | —     | \$4,499 |
| <b>Portege Series</b>   |          |                   |     |           |           |           |       |         |
| #39052                  | 3010CT   | 266 MMX           | 32  | 4.3GB     | —         | 10.4" TFT | 56K   | \$1,699 |
| #43512                  | 7020CT   | 366 PII MMX       | 64  | 6.4GB     | —         | 13.3" TFT | 56K   | \$3,699 |
| <b>Satellite Series</b> |          |                   |     |           |           |           |       |         |
| #43523                  | 4030CDT  | 300 Celeron       | 64  | 4.3GB 24X | 13.3" TFT | 56K       | —     | \$1,999 |
| #37261                  | 4020CDT  | 300 PII MMX       | 64  | 6.4GB 24X | 13.3" TFT | 56K       | —     | \$2,399 |
| #43517                  | 4080XCDT | 366 PII MMX       | 64  | 6.4GB 24X | 14.1" TFT | 56K       | —     | \$3,199 |
| <b>Libretto</b>         |          |                   |     |           |           |           |       |         |
| #39062                  | 110CT    | 233 MMX           | 32  | 4.3GB     | —         | 7.1" TFT  | —     | \$1,899 |

## IBM ThinkPad 390

- 233MHz Pentium processor w/MMX technology
- 3.2GB HD
- 24X CD-ROM
- 12.1" TFT display
- 56Kbps Modem

**\$1,549**  
#37830

| Order#              | Model  | Pentium processor | RAM | HD     | CD  | Display   | Modem | Price   |
|---------------------|--------|-------------------|-----|--------|-----|-----------|-------|---------|
| <b>ThinkPad 380</b> |        |                   |     |        |     |           |       |         |
| #39175              | TP3802 | 233 PII MMX       | 32  | 4.0GB  | 24X | 13.3" TFT | —     | \$1,879 |
| #39180              | TP3802 | 300 PII MMX       | 32  | 4.0GB  | 24X | 13.3" TFT | —     | \$2,269 |
| <b>ThinkPad 560</b> |        |                   |     |        |     |           |       |         |
| #39329              | TP560X | 233 PII MMX       | 32  | 4GB    | —   | 12.1" TFT | 56K   | \$2,399 |
| #39338              | TP560X | 300 PII MMX       | 64  | 6.4GB  | —   | 12.1" TFT | 56K   | \$2,549 |
| <b>ThinkPad 600</b> |        |                   |     |        |     |           |       |         |
| #42428              | TP600E | 300 PII MMX       | 32  | 4.0GB  | 24X | 13.3" TFT | 56K   | \$2,799 |
| #42422              | TP600E | 366 PII MMX       | 64  | 6.4GB  | 24X | 13.3" TFT | 56K   | \$3,099 |
| #42428              | TP600E | 366 PII MMX       | 64  | 6.4GB  | DVD | 13.3" TFT | 56K   | \$4,499 |
| <b>ThinkPad 770</b> |        |                   |     |        |     |           |       |         |
| #42437              | TP7702 | 366 PII MMX       | 128 | 14.1GB | DVD | 13.3" TFT | 56K   | \$4,749 |
| #42441              | TP7702 | 366 PII MMX       | 128 | 14.1GB | DVD | 14.1" TFT | 56K   | \$4,949 |
| <b>ThinkPad 390</b> |        |                   |     |        |     |           |       |         |
| #39180              | TP390  | 233 PII MMX       | 32  | 3.2GB  | 24X | 14.1" TFT | 56K   | \$1,749 |
| #39171              | TP390  | 266 PII MMX       | 64  | 4.3GB  | 24X | 14.1" TFT | 56K   | \$2,499 |

\*Windows 98. \*\*After \$100 mfr. mail-in rebate.  
\*\*\*After \$200 mfr. mail-in rebate. Valid through 4/30/98.

## COMPAQ Presario SMB

- 233 - 366MHz Pentium processor w/MMX technology
- 32MB RAM exp to 160MB
- 4.0 to 6.4GB HD
- 24X CD
- 12.1"-14.1" TFT Display
- 56Kbps Modem
- MS Office 97 SBE V2

Starting at  
**\$2,239**  
#42937

| Order#                        | Model | Processor    | RAM | HD    | CD  | Display   | Modem | O/S    | Price   |
|-------------------------------|-------|--------------|-----|-------|-----|-----------|-------|--------|---------|
| <b>Presario SMB</b>           |       |              |     |       |     |           |       |        |         |
| #42937                        | 122   | 266 MPII MMX | 32  | 4.0GB | 24X | 12.1" TFT | 56K   | Win 98 | \$2,239 |
| #42975                        | 144   | 333 MPII MMX | 64  | 4.0GB | 24X | 13.3" TFT | 56K   | Win 98 | \$2,829 |
| #42978                        | 162   | 366 MPII MMX | 32  | 6.4GB | 24X | 14.1" TFT | 56K   | Win 98 | \$3,279 |
| <b>Armade 1750 Series</b>     |       |              |     |       |     |           |       |        |         |
| #43112                        | 1750  | 300 PII MMX  | 64  | 4.0GB | 24X | 13.3" TFT | 56K   | Win 95 | \$2,559 |
| #43138                        | 1750  | 333 PII MMX  | 64  | 6.4GB | 24X | 13.3" TFT | 56K   | Win 95 | \$2,949 |
| #43145                        | 1750  | 366 PII MMX  | 64  | 6.4GB | 24X | 14.1" TFT | 56K   | Win 95 | \$3,339 |
| <b>New Armade 7800 Series</b> |       |              |     |       |     |           |       |        |         |
| #35469                        | 7800  | 300 PII MMX  | 64  | 8.0GB | DVD | 14.1" TFT | —     | Win 95 | \$3,599 |
| #43318                        | 7800  | 366 PII MMX  | 64  | 14GB  | DVD | 14.1" TFT | 56K   | Win 95 | \$4,649 |
| <b>Armade 3500 Series</b>     |       |              |     |       |     |           |       |        |         |
| #43168                        | 3500  | 333 PII MMX  | 32  | 4.1GB | —   | 12.1" TFT | —     | Win 95 | \$2,899 |
| #43181                        | 3500  | 366 PII MMX  | 64  | 6.4GB | —   | 13.3" TFT | —     | Win 95 | \$3,579 |

## SONY PCG F150

- 300MHz Pentium II processor w/MMX technology
- 32MB RAM exp. to 192MB
- 4.3GB hard drive
- V90 Modem
- 24X CD-ROM
- Win 98
- 13" HPA Display

**\$1,699**  
#42502

| Order# | Model    | Processor   | RAM | HD    | CD  | Display   | Modem | O/S    | Price   |
|--------|----------|-------------|-----|-------|-----|-----------|-------|--------|---------|
| #42502 | PCGF150  | 300 PII MMX | 32  | 4.3GB | 24X | 13" HPA   | V90   | Win 98 | \$1,699 |
| #42512 | PCGF160  | 300 PII MMX | 64  | 4.3GB | 24X | 14.1" TFT | V90   | Win 98 | \$1,899 |
| #42537 | PCGF180  | 333 PII MMX | 64  | 4.3GB | DVD | 14.1" TFT | V90   | Win 98 | \$2,499 |
| #42538 | PCG838   | 366 PII MMX | 64  | 6.4GB | DVD | 13.3" TFT | V90   | Win 98 | \$2,899 |
| #42548 | PCGF190  | 366 PII MMX | 64  | 4.3GB | DVD | 14.1" TFT | V90   | Win 98 | \$2,999 |
| #42559 | PCG505TS | 300 PII MMX | 64  | 4.3GB | —   | 10.4" TFT | V90   | Win 98 | \$1,999 |
| #42569 | PCG505TX | 300 PII MMX | 64  | 6.4GB | —   | 10.4" TFT | V90   | Win 98 | \$2,499 |

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## COMPAQ Presario SMB

- 350 or 450MHz Pentium II processor w/MMX technology
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| <b>Presario SMB Desktops</b> |          |                 |     |        |     |       |      |        |         |
| #42732                       | 310      | 366 Celeron     | 32  | 8.4GB  | 40X | 56K   | T/D  | Win 98 | \$1,119 |
| #38845                       | 330      | 350 PII MMX     | 64  | 10GB   | 40X | 56K   | T/D  | Win 98 | \$1,419 |
| #38848                       | 330      | 450 PII MMX     | 64  | 10GB   | DVD | 56K   | T/D  | Win 98 | \$1,719 |
| <b>Desktops E2 Series</b>    |          |                 |     |        |     |       |      |        |         |
| #42176                       | 4300     | 400 Celeron MMX | 32  | 4.3GB  | —   | —     | T/D  | Win 95 | \$899   |
| #42177                       | 10000CDS | 400 Celeron MMX | 64  | 6.4GB  | —   | —     | T/D  | Win 95 | \$1,119 |
| #36296                       | 4300     | 350 PII MMX     | 64  | 4.3GB  | —   | —     | T/D  | Win 95 | \$1,129 |
| #36314                       | 10000CDS | 400 PII MMX     | 64  | 10.0GB | 32X | —     | T/D  | Win 95 | \$1,479 |
| #36315                       | 10000CDS | 450 PII MMX     | 64  | 10.0GB | 32X | —     | T/D  | Win 95 | \$1,589 |

**\$818**  
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## HP Color Palmtop 660LX w/56K Modem

- 42MB RAM
- Windows CE 2.0
- 10MB ROM
- 56K Modem

## COMPAQ Presario 5070

### 350MHz AMD-K6-2 Processor

- 32MB RAM
- 32X CD
- 4GB hard drive
- 56Kbps modem
- Windows 98

**\$699**  
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| Order# | Model | Processor    | RAM   | HD    | CD  | Modem | Form | System | Price   |
|--------|-------|--------------|-------|-------|-----|-------|------|--------|---------|
| #40891 | 5204  | 350 AMD K6-2 | 64MB  | 4.0GB | 32X | 56K   | MT   | Win 98 | \$799   |
| #40893 | 5220  | 380 AMD K6-2 | 64MB  | 9.0GB | 32X | 56K   | MT   | Win 98 | \$899   |
| #40894 | 5240  | 400 AMD K6-2 | 64MB  | 10GB  | 40X | 56K   | MT   | Win 98 | \$999   |
| #43313 | 5280  | 450 AMD K6-2 | 64MB  | 12GB  | 40X | ADSL  | MT   | Win 98 | \$1,299 |
| #40895 | 5670  | 450 PII MMX  | 128MB | 19GB  | DVD | ADSL  | MT   | Win 98 | \$1,999 |

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| #41175 | 4450  | 366 Celeron | 64MB  | 6.4GB  | 32X | 56K   | Win 98 | \$799   |
| #41204 | 6460  | 400 Celeron | 96MB  | 9.6GB  | 32X | 56K   | Win 98 | \$1,099 |
| #41203 | 64702 | 400 PII MMX | 96MB  | 12.7GB | 32X | 56K   | Win 98 | \$1,399 |
| #42883 | 84902 | 500 PII MMX | 128MB | 19GB   | DVD | 56K   | Win 98 | \$2,199 |

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|--------|---------|-------------|------|-------|-----|-----|------|---------|
| #42122 | 628722U | 333 Celeron | 32MB | 4.2GB | —   | W98 | MT   | \$749   |
| #42123 | 628732U | 366 Celeron | 32MB | 4.2GB | —   | W98 | MT   | \$769   |
| #42410 | 6275H1U | 333 Celeron | 32MB | 4.2GB | —   | W98 | DT   | \$779   |
| #42409 | 6275G3U | 366 Celeron | 32MB | 4.2GB | —   | W98 | DT   | \$849   |
| #42133 | 628241U | 350 PII     | 32MB | 4.2GB | —   | W98 | MT   | \$999   |
| #42395 | 6275B9U | 350 PII     | 32MB | 4.2GB | —   | W98 | DT   | \$1,049 |
| #42396 | 6275F1U | 366 Celeron | 32MB | 4.2GB | 32X | W98 | DT   | \$1,099 |
| #42137 | 628761U | 400 PII     | 32MB | 4.2GB | —   | W98 | MT   | \$1,099 |
| #42382 | 6275B4U | 350 PII     | 64MB | 4.2GB | —   | NT  | DT   | \$1,179 |
| #42397 | 6275M2U | 400 PII     | 32MB | 4.2GB | —   | W98 | DT   | \$1,179 |
| #42394 | 6275B7U | 350 PII     | 32MB | 4.2GB | 32X | W98 | DT   | \$1,199 |
| #42411 | 6275G1U | 366 Celeron | 64MB | 8.4GB | 32X | W98 | MT   | \$1,229 |
| #42139 | 628769U | 400 PII     | 64MB | 8.4GB | 32X | NT  | MT   | \$1,429 |
| #42140 | 628785U | 450 PII     | 64MB | 8.4GB | 32X | W98 | MT   | \$1,499 |
| #42142 | 628786U | 450 PII     | 64MB | 8.4GB | 32X | NT  | MT   | \$1,549 |

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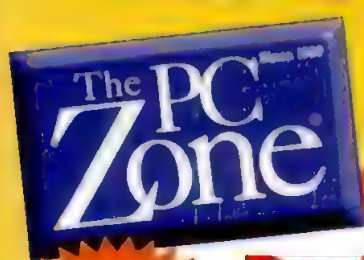
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| 390 P2-233 32/3 2.24X CD 12.1 TFT 56K | #83792 | \$1,089 |
| 390 P2-266 64/4 0.24X CD 14.1 TFT 56K | #83793 | \$1,299 |

#### ThinkPad 600 Series

|                                       |        |         |
|---------------------------------------|--------|---------|
| 600 P2-233 32/3 2.24X CD 12.1 TFT 56K | #05146 | \$1,199 |
| 600 P2-300 64/5 1.24X CD 13.3 TFT 56K | #57165 | \$3,549 |
| 600 P2-300 64/5 1.24X CD 13.3 TFT 56K | #57166 | \$3,549 |
| 600 P2-300 64/5 0 DVD 13.3 TFT 56K    | #57167 | \$3,749 |

#### ThinkPad 770 Series

|                                            |        |          |
|--------------------------------------------|--------|----------|
| 770X P2-300 64/8 1.24X CD 14.1 TFT 56K NT  | #57174 | \$3,749  |
| 770X P2-300 64/8 1 DVD 14.1 TFT 56K        | #57173 | \$3,849  |
| 770X P2-300 128/8 1.24X CD 13.7 TFT 56K NT | #57172 | \$3,949  |
| 770X P2-300 128/8 1 DVD 13.7 TFT 56K       | #57171 | \$4,199  |
| Zip Drive for 770                          | #11997 | \$199.95 |

#### COMPAQ Armada 1700 Series

|                                        |        |         |
|----------------------------------------|--------|---------|
| 1700 P2-233 32/3 2.24X CD 12.1 CSTN    | #74695 | \$1,599 |
| 1700 P2-233 32/4 0.24X CD 12.1 TFT 56K | #08051 | \$1,199 |
| 1700 P2-266 32/4 0.24X CD 13.3 TFT 56K | #08052 | \$1,399 |
| 1700 P2-300 32/5 0.56K 14.1 TFT        | #74694 | \$2,799 |

#### Armada 6500 Series

|                                        |        |         |
|----------------------------------------|--------|---------|
| 6500 P2-300 64/6 4.24X CD 14.1 TFT W95 | #74753 | \$3,199 |
| 6500 P2-300 64/6 4.24X CD 14.1 TFT NT  | #74755 | \$3,799 |

#### Presario 1200 Series

|                                                             |        |          |
|-------------------------------------------------------------|--------|----------|
| 1235 K6-266 32/4 0.24X CD 12.1 HPA                          | #74652 | \$1,299* |
| *After \$100 mfr. mail-in rebate. Low Zone price \$1,399.00 |        |          |
| 1255 K6-333 32/4 0.24X CD 12.1 TFT                          | #99140 | \$1,799  |
| 1260 K6-333 64/6 4.24X CD 12.1 TFT                          | #99145 | \$1,599  |

### Presario 1800 Series

|                                                             |        |          |
|-------------------------------------------------------------|--------|----------|
| 1810 P2-300 64/6 4 DVD2 13.3 TFT                            | #74590 | \$2,699* |
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|-----------------------------------------|---------|---------|
| 506K 13.3 XGA TFT                       | #100293 | \$1,399 |
| 506K 13.3 XGA TFT                       | #100290 | \$1,999 |
| 4000CDT P2-300MHz 64MB/6 4GB HD 24X CD  | #94685  | \$2,399 |
| 4000XCDT P2-366MHz 64MB/6 4GB HD 24X CD | #100292 | \$3,199 |
| 56K Flex Card 14.1 XGA TFT              | #100292 | \$3,199 |

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|                                      |         |         |
|--------------------------------------|---------|---------|
| 7000CT P2-266 32/4 3 56K 12.1 TFT    | #27137  | \$2,399 |
| 7000CT P2-266 32/4 3 56K 12.1 TFT NT | #54511  | \$2,499 |
| 7020CT P2-366 64/6 4 56K 13.3XGA TFT | #105595 | \$3,699 |
| 7010CT W95 P2-300 32/4 3 12.1 TFT    | #56545  | \$2,879 |
| 7010CT NT P2-300 32/4 3 12.1 TFT     | #56546  | \$2,999 |
| 3010CT MMX266 32/4 3 56K 10.4 TFT    | #100242 | \$1,699 |

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| Tecra 8000 P2-300 64/6 4.24X CD 56K 13.3XGA TFT | #04641  | \$3,099 |
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| Tecra 8000 P2-366 128/8 1.24X CD 56K 14.1 TFT   | #105597 | \$3,799 |

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| XE P2-300MHz 64MB/3 8GB HD 24X CD 56K 12.1 TFT Win 98  | #106307 | \$1,962 |
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| XE P2-300MHz 32MB/4 3GB HD 24X CD 12.1 TFT Win 98      | #105239 | \$3,399 |
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| 505TX MMX 300MHz 64MB/6 4GB HD Opt. CD 56K 10.4 XGA TFT Win 98 | #105509 | \$2,499 |
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| HP DeskJet 882C Printer          | #102383 | \$299.98 |
| HP LaserJet 4000 Network Printer | #53213  | \$1,369  |
| Tektronix Phaser 740 Color       | #76646  | \$1,995  |

### Digital Cameras

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| Olympus D-620L (1280x1024)  | #96804 | \$1,199   |
| Kodak DC280 (1536x1024)     | #73283 | \$699.98  |
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| Agfa ScanJet 1212U     | #100729 | \$179.98 |

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| ViewSonic G790 17.1" view 25 dp    | #46781 | \$579.98 |
| Sony W900 21" 22.5 view 25-28 dp   | #00665 | \$2,149  |
| ViewSonic VP1415 MM 15" flat panel | #46787 | \$879.98 |

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| USR 56K V.90 External Faxmodem                           | #57378 | \$127.98* |
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| Intel Pro-100 Plus 10/100 PCI Card                 | #44782 | \$69.98 |
| NetGear 10/100 PCI Card                            | #41161 | \$28.98 |
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| 3Com OfficeConnect 10Base-T Hub 4/100TX (4 RU-45)  | #32044 | \$96.98 |
| Intel InBusiness 4 Port 100TX (4 RU-45)            | #50789 | \$98.98 |
| Intel InBusiness 4 Port 100TX (4 RU-45)            | #57333 | \$98.98 |

### NetGear 10/100 8Port Hub w/UpLink

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| NetGear 10/100 8Port Hub w/UpLink       | #00853 | \$218.98 |
| Intel InBusiness 8Port 10/100 (8 RU-45) | #15875 | \$249.98 |
| Asante FriendlyNet 4004E                | #15877 | \$218.98 |

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| Quantum 10.2GB EIDE Ultra ATA 9.5ms 512K 5400RPM        | #15027 | \$229.98 |
| IBM 8.4GB EIDE Ultra DMA 9.5ms 512K 5400RPM             | #55125 | \$198.98 |
| Quantum ValueLine 11.4GB SCSI-3 Wide 7.8ms 512K 7200RPM | #70393 | \$264.98 |
| Quantum Stratus 6.4GB Ultra SCSI-3 10ms 128K 5400RPM    | #57030 | \$350.98 |
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| Iomega Zip 100MB USB EXT Drive       | #93251  | \$149.95 |
| Iomega Zip 100MB Parallel Ext Recond | #55182  | \$79.95  |
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| Iomega Jaz 2GB SCSI External Drive   | #95234  | \$349.95 |

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| Microsoft Office 97 Pro w/BookShelf Basics              | #40206  | \$449.98  |
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| Symantec PCAnywhere 32 8.0 H&R                          | #27304  | \$156.98  |
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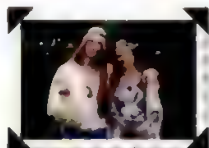
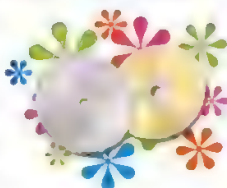
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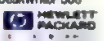
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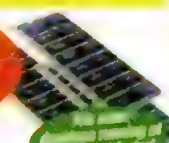
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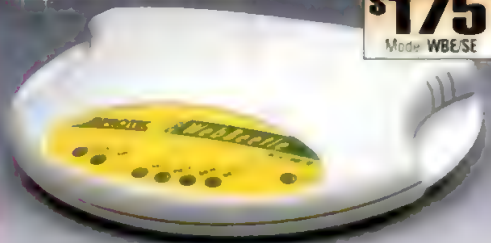
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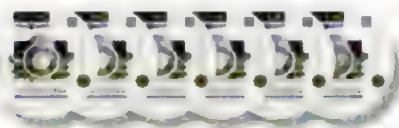
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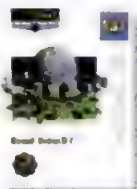
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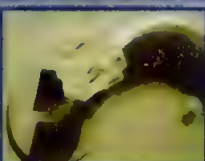
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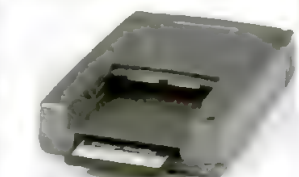
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| 512MB | 2.5V | 20  | 20  | 20  |
| 256MB | 2.5V | 20  | 20  | 20  |
| 128MB | 2.5V | 100 | 100 | 100 |
| 64MB  | 2.5V | 100 | 100 | 100 |
| 32MB  | 2.5V | 200 | 200 | 200 |
| 16MB  | 2.5V | 400 | 400 | 400 |

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|------------------|-------|-------|-------------------|-------|-------|
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| Pentium 4 500MHz | 512K  | 100   | Pentium 4 600MHz  | 512K  | 100   |
| Pentium 4 600MHz | 512K  | 100   | Pentium 4 700MHz  | 512K  | 100   |
| Pentium 4 700MHz | 512K  | 100   | Pentium 4 800MHz  | 512K  | 100   |
| Pentium 4 800MHz | 512K  | 100   | Pentium 4 900MHz  | 512K  | 100   |
| Pentium 4 900MHz | 512K  | 100   | Pentium 4 1000MHz | 512K  | 100   |

## 72 PIN SIMMS (70ns)

| 72 PIN SIMMS | MB   | 67  | PC  | PC  |
|--------------|------|-----|-----|-----|
|              |      | 100 | 100 | 100 |
| 1GB          | 2.5V | —   | —   | —   |
| 512MB        | 2.5V | 20  | 20  | 20  |
| 256MB        | 2.5V | 20  | 20  | 20  |
| 128MB        | 2.5V | 100 | 100 | 100 |
| 64MB         | 2.5V | 100 | 100 | 100 |
| 32MB         | 2.5V | 200 | 200 | 200 |
| 16MB         | 2.5V | 400 | 400 | 400 |

## 30 PIN SIMMS

| 30 PIN SIMMS | MB   | 67  | PC  | PC  |
|--------------|------|-----|-----|-----|
|              |      | 100 | 100 | 100 |
| 1GB          | 2.5V | —   | —   | —   |
| 512MB        | 2.5V | 20  | 20  | 20  |
| 256MB        | 2.5V | 20  | 20  | 20  |
| 128MB        | 2.5V | 100 | 100 | 100 |
| 64MB         | 2.5V | 100 | 100 | 100 |
| 32MB         | 2.5V | 200 | 200 | 200 |
| 16MB         | 2.5V | 400 | 400 | 400 |

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| Hard Drive        | Capacity | Price | Hard Drive        | Capacity | Price |
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| Seagate Barracuda | 4.1GB    | 100   | Seagate Barracuda | 6.1GB    | 100   |
| Seagate Barracuda | 6.1GB    | 100   | Seagate Barracuda | 8.1GB    | 100   |
| Seagate Barracuda | 8.1GB    | 100   | Seagate Barracuda | 10.1GB   | 100   |
| Seagate Barracuda | 10.1GB   | 100   | Seagate Barracuda | 12.1GB   | 100   |
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| Seagate Barracuda | 16.1GB   | 100   | Seagate Barracuda | 18.1GB   | 100   |
| Seagate Barracuda | 18.1GB   | 100   | Seagate Barracuda | 20.1GB   | 100   |

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| Compaq 486 100MHz | 32MB     | 100   | Compaq 486 100MHz | 64MB     | 100   |
| Compaq 486 100MHz | 64MB     | 100   | Compaq 486 100MHz | 128MB    | 100   |
| Compaq 486 100MHz | 128MB    | 100   | Compaq 486 100MHz | 256MB    | 100   |
| Compaq 486 100MHz | 256MB    | 100   | Compaq 486 100MHz | 512MB    | 100   |
| Compaq 486 100MHz | 512MB    | 100   | Compaq 486 100MHz | 1GB      | 100   |

### IBM NOTEBOOK/LAPTOP MEMORY

| Model          | Capacity | Price | Model          | Capacity | Price |
|----------------|----------|-------|----------------|----------|-------|
| IBM 486 100MHz | 16MB     | 100   | IBM 486 100MHz | 32MB     | 100   |
| IBM 486 100MHz | 32MB     | 100   | IBM 486 100MHz | 64MB     | 100   |
| IBM 486 100MHz | 64MB     | 100   | IBM 486 100MHz | 128MB    | 100   |
| IBM 486 100MHz | 128MB    | 100   | IBM 486 100MHz | 256MB    | 100   |
| IBM 486 100MHz | 256MB    | 100   | IBM 486 100MHz | 512MB    | 100   |
| IBM 486 100MHz | 512MB    | 100   | IBM 486 100MHz | 1GB      | 100   |

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| Model             | Capacity | Price | Model             | Capacity | Price |
|-------------------|----------|-------|-------------------|----------|-------|
| Compaq 486 100MHz | 16MB     | 100   | Compaq 486 100MHz | 32MB     | 100   |
| Compaq 486 100MHz | 32MB     | 100   | Compaq 486 100MHz | 64MB     | 100   |
| Compaq 486 100MHz | 64MB     | 100   | Compaq 486 100MHz | 128MB    | 100   |
| Compaq 486 100MHz | 128MB    | 100   | Compaq 486 100MHz | 256MB    | 100   |
| Compaq 486 100MHz | 256MB    | 100   | Compaq 486 100MHz | 512MB    | 100   |
| Compaq 486 100MHz | 512MB    | 100   | Compaq 486 100MHz | 1GB      | 100   |

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| Model              | Capacity | Price | Model              | Capacity | Price |
|--------------------|----------|-------|--------------------|----------|-------|
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| Toshiba 486 100MHz | 32MB     | 100   | Toshiba 486 100MHz | 64MB     | 100   |
| Toshiba 486 100MHz | 64MB     | 100   | Toshiba 486 100MHz | 128MB    | 100   |
| Toshiba 486 100MHz | 128MB    | 100   | Toshiba 486 100MHz | 256MB    | 100   |
| Toshiba 486 100MHz | 256MB    | 100   | Toshiba 486 100MHz | 512MB    | 100   |
| Toshiba 486 100MHz | 512MB    | 100   | Toshiba 486 100MHz | 1GB      | 100   |

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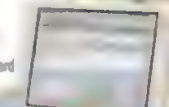
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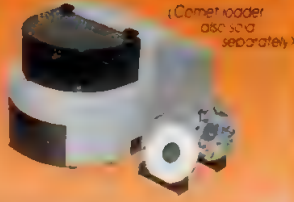


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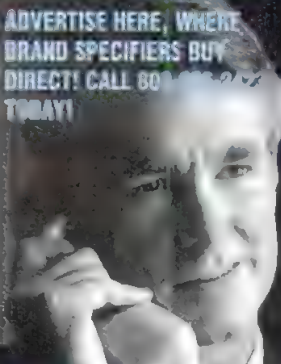
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# ABOVE ALL, ELSA.

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It runs 3D at an unheard of 2048 x 1536 resolution and 2D that makes all the other stuff a dream. Is it fast?...heh...heh...heh.



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# AFTERHOURS

THE HOME SIDE OF COMPUTING



profiles, manage frequent-flier programs, and take advantage of discount hotel and car rental plans. Much like travel agents, these services let users build an itinerary from flight to hotel. These itineraries can be saved and provide a handy reference for future trips. Many sites also provide a paging service that alerts you to flight changes.

## VACATION TRAVEL

In the past, the vacation-planning aspect of travel Web sites—the cruises, week-long resort packages, and ski trips—was sadly lacking. Fortunately, companies have seen the error of their ways and have actively increased their leisure offerings while allowing you to track low fares and deals. You can now book complete packages online, as well as find out what's available in terms of discounts and activities for your kids.

Many sites have linked up with well-known travel guides, such as Fodor's or Frommer's, so you can really get a feel for your destination town or city.

## TRAVEL WEB SITES

# Traveling.com

By Jennifer Triverio

**A**h, the luxury of having your own personal travel agent: You pick up the phone and there's a friendly voice telling you which flights are available and where your seat will be (aisle, of course), and assuring you that your mid-size rental car will be waiting at the airport for your short drive to a four-star hotel. Although many larger corporations can provide this amenity, most business travelers are left to slosh their own way through the mire of airline fares, car rentals, and

hotel bookings. And when it comes to planning leisure travel—with the kids and Grandma in tow—let's just say that's a whole other can of worms.

Happily, there is an attractive alternative: Internet-based travel services. And though using these sites won't be quite as easy as booking a trip through a travel agency, the sites do provide plenty of options and information for booking airline seats, rental cars, and hotel rooms. We looked at six services: Biztravel.com, Internet Travel Network (ITN), MSN Expedia, Preview Travel, TheTrip.com, and Travel-

ocity. The sites offer various bells and whistles, but all provide a solid means of making your travel arrangements.

Of course, there's no substitute for an intuitive site that's logically laid out and easy to use. But beyond that, you'll find from these reviews (and in your own dealings with the services) that it's very much a matter of preference: Is the management of frequent-flier miles important to you? How about local info about your destination city? Or real-time graphical seat selection?

## BUSINESS TRAVEL

Most of these sites were designed with the business traveler in mind. They let users create and save detailed travel

## ALL ABOARD

If you have a travel agency you're just thrilled with, keep it. But if that's a hat you've been wearing, you should definitely take your plans online. Remember, though, this isn't a two-mouse-clicks-and-I'm-off proposition. You'll have to invest some time setting up your account and getting going. That said, in most cases, it's worth the trip.

## QUICK CLIPS

Battle the Empire, play a Clapton tune on the guitar, or just conquer the world: A quick look at five new titles in the PC entertainment market. *Page 261.*

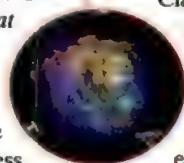


ILLUSTRATION BY CHARLENE POTTS



# AFTER HOURS

## Biztravel.com



Biztravel.com is the king when it comes to arranging and booking business travel. The site's depth and thoroughness make it our Editors' Choice for business travel for the second year in a row.

Biztravel.com's travel-profile element is unparalleled. Completing yours will require a time investment (perhaps 20 to 30 minutes), but once you set up your profile, Biztravel.com takes care of tracking everything from your 20 frequent-flier plans to your hotel discount programs. You can choose itineraries that take advantage of specific bonus plans and optimize your rewards. The site can even analyze your eligibility for seating upgrades on the flights you have selected—and then go ahead and request an upgrade when the availability window opens (usually

24 to 48 hours before the flight). Impressive.

Like many other sites, Biztravel.com provides driving directions and restaurant and weather information for about 60 cities worldwide. It also has a forum where you can discuss a city's pros and cons with others.

Because this site is so strongly focused on business travelers, you won't find a fare tracker or some of the other leisure-oriented information travel sites often provide. Though this site has beefed up its vacation offerings, they are not the first reason to become a loyal user. You'll end up having to cobble a trip together from

**BIZTRAVEL.COM**  
★★★★★  
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www.biztravel.com.



## INTERNET TRAVEL NETWORK

★★★★★  
Internet Travel Network Inc.,  
800-253-9822,  
www.itn.com.

various hotel and tour listings that aren't quite integrated into the slick vacation deals you'll find at a site like MSN Expedia. No matter—business travelers will keep returning to this site with pleasure.

## Internet Travel Network

Internet Travel Network (ITN) is a formidable business-oriented service that offers many of the components of Biztravel.com. Its intuitive interface and ease of use make it ideal for professionals who travel occasionally but don't necessarily crisscross the country every other week.

The detailed profile lets you enter all your plane, car, and hotel preferences, as well as your reward-program account information. Like MSN Expedia, ITN utilizes MaxMiles MileageMiner to track your



frequent-flier status.

Planning an itinerary is simple, with good integration of flight, hotel, and car reservations. You can select your plane seating as well as view driving directions and hotel maps from the itinerary section.

In case you'd like to learn a little bit more about your destination, ITN features travel information from the Rough Guide series—fun, useful tips about the sights and sounds of a city.

In addition to facts and figures about your destination, ITN tries to help you nail down the best fare: Fare Mail lets you track appealing prices for up to four destinations, and the Fare Ticker, a Java applet that runs on your desktop, brings you the latest and greatest deals.



business specials, and complete air, car, and hotel booking on one itinerary. Additional features affecting the rating include security, real-time information on plane

**Business travel.** Factors that affect a site's power and depth rating include the flexibility and level of detail in creating a passenger profile, the tracking of

arrivals and departures, interactive mapping services for ground travel, and the ability to change an itinerary. The ease of use rating reflects the interface's usability, the management of frequent-flier miles, and the availability of "e-tickets."

**Vacation travel.** We evaluate the options offered and the ease with which a user can plan and book a vacation. The breadth of tour and resort options, kids' specials, online price quotes, and discounts for

online usage factor into the power and depth rating. The ability to book cars, hotels, and local tours improves this rating. Usability and integration of tour packages and reservation systems affect the ease of use rating.

**Fare tracking.** We evaluate how well a site notifies a customer of low airfares and available discounts. Updated and customized information is an important consideration.

|                        | biztravel.com | INTERNET TRAVEL NETWORK | Expedia Travel | Travelocity | THE TRIP 5 | Travelocity |
|------------------------|---------------|-------------------------|----------------|-------------|------------|-------------|
| <b>POWER AND DEPTH</b> |               |                         |                |             |            |             |
| Business travel        | Excellent     | Good                    | Good           | Good        | Good       | Good        |
| Vacation travel        | Good          | Good                    | Excellent      | Good        | Fair       | Fair        |
| Fare tracking          | N/A           | Good                    | Fair           | Good        | Excellent  | Good        |
| <b>EASE OF USE</b>     |               |                         |                |             |            |             |
| Business travel        | Excellent     | Good                    | Good           | Good        | Good       | Good        |
| Vacation travel        | Good          | Good                    | Excellent      | Good        | Fair       | Fair        |
| Fare tracking          | N/A           | Excellent               | Good           | Good        | Good       | Good        |

N/A—Not applicable. The site does not have this feature.



# You Name It, The XL<sup>2</sup>'s Got It.

**This thin, all-in-one notebook is loaded with features plus Intel's speedy new chips!**

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And there's more! Like the speedy Intel® Mobile Pentium® II Processor featuring MMX™ technology at 300 MHz (or faster), fast SDRAM up to 128 MB, and a huge Ultra DMA hard drive. Plus, there's a dazzling 14.1" active matrix display. And it's only 1 1/2" thin. You just might call this the notebook of your dreams! And it's easy to order online – at [www.winbook.com](http://www.winbook.com) or by phone – so come and get it!



**Slim and lightweight**  
at only 1 1/2" high



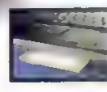
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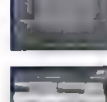
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**56k capable\* v.90** internal fax/modem



**2-button touchpad** and pointing stick (active simultaneously)



**Parallel, Serial, 2 PCMCIA, Card Bus, S-video, USB** and TV out ports

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- 45 Watt-hour Lithium Ion Smart Battery
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Vacation packages are in line with those of Biztravel.com and other business-oriented sites. ITN partners with three companies—Continental, Delta, and Voyages—to offer prefab vacations. You can book them online or through an 800 number.

We liked ITN because it's a well-focused site that puts the emphasis on getting you where you need to go without all the bells and whistles.

## MSN Expedia



MSN Expedia, Microsoft's foray into the travel industry, has an updated interface and some new navigation features that make it easier to use. Perfect for the beginner, Expedia offers lots of assistance and plenty of articles, maps, and documentation to ensure you're comfortable on



MSN EXPEDIA  
★★★★★  
Microsoft Corp.,  
800-938-4500,  
[www.expedia.com](http://www.expedia.com)

your chosen trip. For these reasons, we've awarded it the Editors' Choice as best leisure-travel site.

Flight, car, and hotel wizards adeptly take you through the booking process after you've completed your travel profile. Seat and Hotel Pinpointers are handy features that let you view seating availability on flights and hotel locations in a chosen destination (for example, whether a hotel is near the airport or downtown). You can easily jump from your airline reservations to booking a hotel or car; every-

thing is well integrated. For quick trip planning, there is the RoundTrip Fare Finder tool, which requires minimal info input and returns

a list of flight options.

For vacation planning, Expedia links you to a range of services such as DeltaVacations and the Online Vacation Mall. The site's in-depth world guides and editorials will help give you a feel for hundreds of destinations. There are also a bulletin board and a forum that let travelers share their experiences with others.

In addition to supplying numerous resources such as a currency converter and up-to-the-minute flight info, MSN Expedia has recently teamed with MaxMiles to provide frequent-flier account management. The Fare Tracker option could be more robust, though: You can't specify price limits.

Perhaps the only bad thing about Expedia is that it is so popular. Several times while testing during peak hours (lunchtimes, mostly), we were told that the system was busy and we'd have to try again later.

## Preview Travel

Sporting a balance of leisure and business travel resources, Preview Travel has packed a lot of information into its stylish site, and the improvements it has made over the past year are dramatic.

Getting started on Preview Travel entails entering your personal information, frequent-flier account numbers, and airline, car-rental, and hotel preferences. You can choose to create a leisure or a business profile (choose business if you plan to do both kinds of traveling) and

## Priceline.com

Priceline.com (203-705-3034, [www.priceline.com](http://www.priceline.com)) gives you the chance to "name your own price" for airline tickets and hotel rooms.

Flexibility is key when dealing with Priceline: You're much more likely to get a ticket if you're willing to drive to one of several different airports in a given region. And you've got to be ready to go any time from 8:00 A.M. to 10:00 P.M. on the day of your



requested departure. There are also a few caveats: You can't request a specific airline, and you won't earn any frequent-flier miles.

The best way to approach the bidding strategy is to find out the lowest price an airline has sold this ticket for (usually the 21-day advance purchase fare). Priceline.com isn't the best way to go if you are booking a trip a month in advance—after all, at that time, you will be getting the best fare and you have your choice of airlines, airports, and travel times—but if you want to avoid the last-minute high-priced ticket, it's worth a try.

We decided to give Priceline.com a spin and bid. We bid on round-trips from New York City to four locations throughout the U.S.: Las Vegas (\$330), Nashville (\$280), New Orleans (\$180), and Seattle (\$460). The site honored all but the New Orleans bid.

## PC MAGAZINE EDITORS' HOT LINKS

### [www.pcmag.com/hotlinks](http://www.pcmag.com/hotlinks)

Travel planning goes far beyond booking your flight and hotel. Here are a handful of sites to help you with the fine details.

#### ► Sidewalk

[national.sidewalk.msn.com](http://national.sidewalk.msn.com)

Sidewalk can carry you in the right direction. Choose from a list of 70 U.S. cities from Albany to Winston-Salem, and focus in on the best restaurants, nightlife, and shopping in the area.

#### ► The Zagat Survey

[www.zagat.com](http://www.zagat.com)

For some, the Zagat Survey—the restaurant-review book series that now covers 45 cities—is like a bible. Perish the thought of entering an eatery that doesn't have Zagat's seal of approval. Though not as comprehensive as the books, the site is growing and worth keeping an eye on.

#### ► Resort Sports Network

[www.rsn.com](http://www.rsn.com)

Sports fans, listen up: If you

want to go where the action's hot, visit Resort Sports Network. Showcasing the best places to tackle the slopes, the greens, or the mountain bike trails, Resort Sports Network also offers links to online travel-booking sites.

#### ► The Bureau of Consular Affairs

[travel.state.gov](http://travel.state.gov)

The Web site of the Bureau of Consular Affairs, a division of the U.S. State Department, provides some valuable information for international travelers. The site includes the phone numbers you'll need in an emergency, passport and currency info, and judicial regulations and policies.

#### ► Business Travel Net

[www.business-travel-net.com](http://www.business-travel-net.com)

A treasure trove of information for the business traveler, Business Travel Net pools the resources of dozens of sites to ensure you're well armed with the facts before you embark on your trip.



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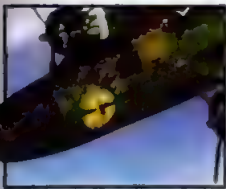
### Now Anyone Can Create Amazing 3D Graphics.

Finally, a breakthrough that lets everyone from school kids to graphic artists, from web designers to Hollywood animators, make stunning 3D graphics. Amorphium is easy to use but it's also incredibly powerful. That's because it's from Play, the same people who created the 3D technology used to make Oscar-winning visuals for "Terminator II", "Titanic" and the "Star Wars Special Edition" Releases.



#### 3D Create

Amorphium lets you create in three dimensions as simply as shaping clay with your fingers. Push, pull, twist and tweak with dozens of interactive tools—all in real-time. You can even use a traditional potter's wheel!



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#### 3D Internet

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—Time Magazine

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can add information for multiple relatives or colleagues to your profile. This section is straightforward and quick. And your information (along with any itineraries you create) is saved for future use.

Those interested in securing the most inexpensive fares available will appreciate Preview Travel's Low Fare Express and Fare Alerts sections. Low Fare Express lists the seven lowest fares that match your itinerary, and Fare Alerts sends e-mail notifications when flights to specified destinations (you can choose up to three) reach target price ranges.

On the vacation side of the site, you can now book packages and cruises online. Information about your desired destinations is provided by the wonderfully insightful Fodor's travel guides. Choosing a package is simple, but—as with most of these sites—you'll have more schedul-

ing freedom if you choose your own hotel and flight combinations.

The only quibble we have with this altogether impressive site is that we wish the booking

both business and pleasure travel in a no-nonsense fashion.

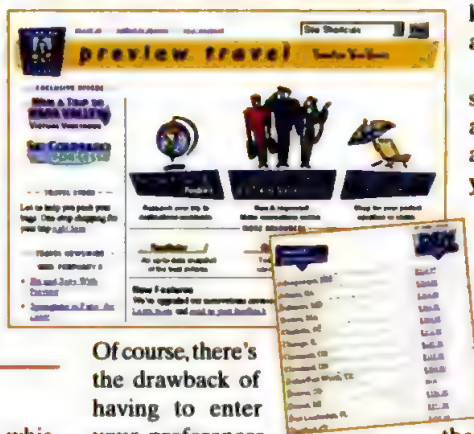
TheTrip.com makes an easy task of booking a flight quickly, and you don't have to register or create a user profile to get going.

**PREVIEW TRAVEL**  
★★★★★  
Preview Travel Inc.,  
800-988-9200,  
[www.previewtravel.com](http://www.previewtravel.com)

process were a bit more streamlined: As it is, you book a flight and then go all the way back to the beginning to start booking a hotel.

## TheTrip.com

Without all the bells and whistles found at some of the other travel sites in this roundup, TheTrip.com, which is run by ITN, may at first seem somewhat anemic. It is, however, a solid service that lets you book



Of course, there's the drawback of having to enter your preferences each time you book a flight.

If making flight arrangements leaves you scratching your head in confusion, you'll appreciate the Further Assistance section, which offers

advice on how to secure the lowest fare (pick a flight with plenty of seats left) and how to ensure stress-free travel. Complete Travel magazine, another component of the site, also keeps you abreast of news and travel issues.

The Historical Airfare section is also worth noting, as it provides data on the average fares over the past year for over 1,000 destinations. If you want to know whether you're getting a great deal, it's a good way to compare costs. And if you're looking for great deals, you can be notified of them (up to ten destinations) via e-mail with the Deals-2-U service.

Those awaiting a friend or relative's arrival will appreciate the flight tracker, which charts any plane's exact location—be it at the departure gate or in the air over Iowa.



# Do YOU wanna take it Online?

Opinions

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[www.pcmag.com](http://www.pcmag.com)

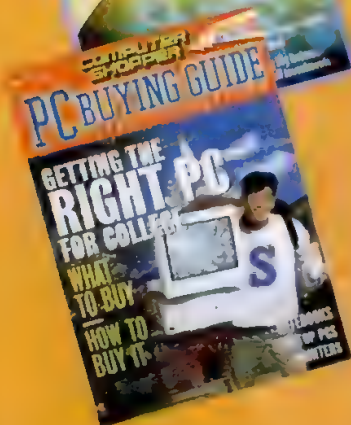




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# AFTER HOURS

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TRIP:MILES

four options: the Fare Watcher Email, Special Deals, Fare Listings, and Consolidator Fares. Each gives you the means to follow the fares for specific flights or just keep an eye out for good deals in general. Some of the fares delivered were a bit questionable, though: When looking for the best price for a round-trip ticket from New York to New Orleans, we were told that the fare would be \$990. Other sites offered the same trip for anywhere from \$200 to \$300.

Booking flights, cars, and hotels is straightforward and easy—and the travel profile you create when you become a member lets you designate your preferences for each type of accommodation. If you're

interested in more than just a flight from point A to point B, take note of the bed-and-breakfast locator and the vacation packages sections. We especially liked the Cruise Critic section, which offers unbiased reviews of a variety of cruises.

Travelocity has oodles of potential, but the site just needs more polish.

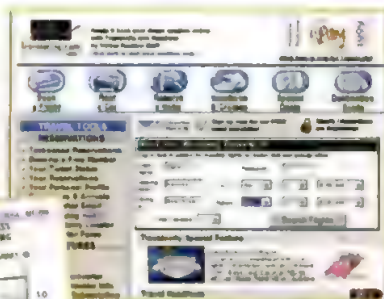
In general, TheTrip.com is well above average if you want to make travel plans on an infrequent basis. If you're a frequent flier, you'd do better with some of the other sites, which track mileage and save your preferences and itineraries.

## Travelocity

Travelocity has always been a noteworthy business-oriented site. It has now gone that extra step and integrated some great vacation options as well. If only it were accessible on a consistent basis! Time and again during our testing, we were subjected to

error messages stating that the site "couldn't process the last entry." This occurred during flight selections, hotel reservations, and car rentals. This was unfortunate, because when the site worked properly we had nothing but praise for it.

The nicely laid out menu on the Travelocity site puts all the planning tools at your fingertips. From booking a flight to tracking fares (you can keep tabs on up to five round-trip excursions), you're only a click away. With regard to searching out the lowest fares, Travelocity gives you



TRAVELLOCITY

★★★★★

The Sabre Group Inc.,  
817-983-3372,  
www.travelocity.com.

## Which Window Is Links LS?



The worlds best selling PC golf sim is now more realistic than ever. Featuring Arnold Palmer, St Andrews and over 25 add-on courses. Compare the center window (Links LS '99 screen shot) to the actual photos on either side.

1-800-800-4880

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## Quick Clips

### Day-Savor

Whether it's golf, astrology, or angels that peaks your interest, there's a Day-Savor calendar for you. A combination daily planner and personal pep squad, Day-Savor's 14 titles offer perpetual calendars and



daily messages (complete with art and music). The daily tips or motivational quotes pop up as you boot your PC. \$16.95 list; KaizenWorks Publishing Inc., 888-329-7286, [www.daysavor.com](http://www.daysavor.com).

### Global Domination

From the title, you might think this is a gamer's dream. It's more like a nightmare. Global Domination's 20 missions are extremely repetitive

(defend your territory and destroy the enemy's), and the documentation is unforgivably vague. \$49.95 list; Psygnosis, 800-438-7794, [www.psygnosis.com](http://www.psygnosis.com).

### eMedia Guitar Songs, Vol. 1

eMedia has augmented its highly regarded Guitar Method 1 and Guitar Method 2 with a standalone CD-ROM of 21 additional songs. Rock, blues, folk, country, and classical tunes by the likes of Santana, Eric Clapton, Willie Nelson, and Bonnie Raitt are presented in tablature and standard notation along with a tuner and other features. \$29.95 list; eMedia Corp., 206-329-5657, [www.emedia.org](http://www.emedia.org).



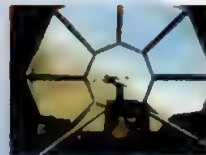
### Pinky and the Brain: World Conquest

When it's software we're talking about, World Conquest is much better than Global Domination.

This maze-based arcade game will be a hit with fans of the like-named television show (authentic character voices and funny quips abound). The multiplayer action is fast and furious, but single-player mode gets a little stale. \$20 street; SouthPeak Interactive, 800-774-6183, [www.southpeak.com](http://www.southpeak.com).

### Star Wars: Rogue Squadron 3D

Don't expect to find the depth or complexity of TIE Fighter or Jedi Knight in Rogue Squadron. It's an arcade-style shooter—but it's a lot of fun. The graphics are intense (3-D acceleration is required), and the game's 16 missions (plus bonus levels) are fast-moving and engaging. As Luke Skywalker, you must lead the Rogue Squadron against the evil Empire. May the force be with you. \$49.95 list; LucasArts, 888-532-4263, [www.lucasarts.com](http://www.lucasarts.com).



## Coming Up

What's in the Next Issue of *PC Magazine*

### Choosing an ISP

All Internet service providers are not created equal. Ease of setup, content offerings, reliability, customer service—these are just some of the features *PC Magazine* will evaluate in this roundup of eight national ISPs. Read it to learn which ones offer the best combination of performance and value and whom you can trust with your Internet access.

### The Fastest Internet Connections

This may be the year you say goodbye to your modem. Cable, DSL, and satellite services are rolling out rapidly across the U.S., offering continuous Internet connections that are 7 to 50 times the speed of conventional modems. *PC Magazine* Labs will test these technologies in cities across the country to tell you whether the cable and phone companies live up to their performance claims and how to choose the best service.

### Your Family Tree

After Hours will take a look at one of the nation's most popular hobbies: tracing your lineage. We'll review four of the top-selling programs on the market today, and we'll explore online resources that may prove invaluable in tracking your past.



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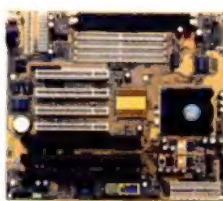
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Tiger M-571 Pictured

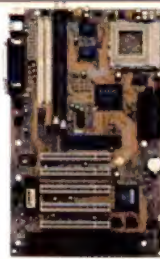
**Tiger 571** Form Factor: AT • CPU: Socket 7 • Bus Speed: Up to 63 MHz • On Board Video: PCI 4MB • On Board Audio: YES • PCI Slots: 4 • ISA Slots: 3 • Memory: 20DIMM/4SIMM • Max Memory: 128/256 MB

**Tiger 573** Form Factor: AT • CPU: Socket 7 • Bus Speed: Up to 75MHz • On Board Video: No • On Board Audio: YES • PCI Slots: 4 • ISA Slots: 2 • Memory: 20DIMM/4SIMM • Max Memory: 128/256 MB

## Tiger SY-SEMA ATX Super Socket 7

**Motherboard & Case:** Motherboard mounted in dual-cooling fan ATX case with 1MB Cache; 235-watt power supply, cables, manual

**Pre-Assembled Kits:** Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56KFlex faxmodem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.



### Tiger SY-SEMA Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Socket 7 • Bus Speed: Up to 100 MHz • AGP Slots: 1 • PCI Slots: 5 • ISA Slots: 2 • Memory: 20DIMM/2 SIMM Sockets • Max Memory: 512MB

## Tiger 6KE LX, 6BE+ BX AGP Slot 1

FREE FLOPPY DRIVE!

**Retail Motherboard:** Motherboard cables & manual

**Motherboard & Case:** ready to assemble! Includes motherboard in dual-cooling fan case; 235 Watt power supply, cables & manual



### Tiger 6KE LX Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 66 MHz • PCI Slots: 4 • ISA Slots: 3 • Memory: 3 DIMM Sockets • Max Memory: 384 MB

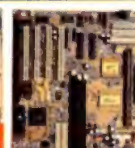
### Tiger 6BE+ BX Motherboard Features At-A-Glance

Form Factor: ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • PCI Slots: 4 • ISA Slots: 3 • Memory: 3 DIMM Sockets • Max Memory: 768 MB

## Tiger 767 AT, 760 ATX Slot 1

**Motherboard & Case:** Motherboard mounted in dual-cooling fan case; cables & manual

**Pre-Assembled Kits:** Motherboard in dual-cooling fan case; keyboard, speakers, mouse, 3D AGP video, 56KFlex faxmodem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.



**Tiger 767** Form Factor: AT • CPU: Slot 1 • Bus Speed: Up to 100 MHz • On Board Video: 8MB AGP • On Board Audio: YES • PCI Slots: 4 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB

**Tiger 760** Form Factor: Micro ATX • CPU: Slot 1 • Bus Speed: Up to 100MHz • On Board Video: 8MB AGP • On Board Audio: YES • PCI Slots: 3 • ISA Slots: 1 • Memory: DIMM • Max Memory: 768 MB

| MOTHERBOARD SPECIFICATIONS                                   |                                                                                    | MOTHERBOARD ONLY |           | MOTHERBOARD & CASE |           | PRE-ASSEMBLED KITS |          |
|--------------------------------------------------------------|------------------------------------------------------------------------------------|------------------|-----------|--------------------|-----------|--------------------|----------|
| Motherboard Design                                           | Processors Supported                                                               | Item No.         | 1-2 units | 3+ units           | Item No.  | 1-2 units          | 3+ units |
| <b>Tiger 571 AT</b> including Wave Table sound and PCI video | AMD Up to K6-300 & K62-266<br>Intel Pentium up to 233 MMX<br>IBM/Cyrix Up to PR300 | MB1-C-1B         | \$75.99   | \$68.99            | BB1-C-1B  | \$124.99           | \$114.99 |
| <b>Tiger 573 AT</b> including Wave Table sound               | AMD Up to K6-300<br>IBM/Cyrix Up to PR300;<br>Intel Pentium up to 233 MMX          | MB1-E-8A         | \$39.99   | \$37.99            | BB1-E-8A  | \$99.99            | \$89.99  |
| <b>Tiger SY-SEMA Super Socket 7</b> 1MB Cache                | All AMD Up to K62-400;<br>Intel Pentium up to 233 MMX<br>IBM/Cyrix up to MII 350   | MB1-T-7A         | \$59.99   | \$54.99            | BB1-C-2C  | \$129.99           | \$114.99 |
| <b>Tiger 767 AT Slot 1</b> with Sound & AGP video            | Celeron up to 333MHz<br>Intel Pentium II up to 500MHz                              | MB1-E-5A         | \$99.99   | \$91.99            | BB1-E-5A  | \$154.99           | \$142.99 |
| <b>Tiger 760 Micro-ATX Slot 1</b> w/Sound & AGP video        | Celeron up to 333MHz<br>Intel Pentium II up to 500MHz                              | MB1-E-6A         | \$99.99   | \$91.99            | BB1-E-6A  | \$139.99           | \$128.99 |
| <b>Tiger 6KE LX ATX Slot 1</b>                               | Celeron up to 333MHz<br>Intel Pentium II up to 333MHz                              | MB1-T-10A        | \$46.99   | \$37.99            | BB1-T-10A | \$114.99           | \$99.99  |
| <b>Tiger 6BE+ BX ATX Slot 1</b>                              | Celeron up to 500MHz<br>Intel Pentium II up to 500MHz                              | MB1-T-9A         | \$84.99   | \$77.99            | BB1-T-9A  | \$149.99           | \$139.99 |

## Power Your Motherboard With A Premium Processor!

### AMD K6-2 With 3DNow!

Tiger recommends the Super Socket 7 motherboard with these CPUs

| AMD K6-2 Processors           | 1-2 Units | 3 units or more |
|-------------------------------|-----------|-----------------|
| #CP2-K62-300 300 3DNow!       | \$74.99   | \$72.99*        |
| #CP2-K62-333 333 3DNow!       | \$89.99   | \$85.99**       |
| #CP2-K62-350 350 3DNow!       | \$107.99  | \$102.99*       |
| #CP2-K62-380 380 3DNow!       | \$144.99  | \$137.99**      |
| #CP2-K62-400 400 3DNow!       | \$164.99  | \$156.99*       |
| #CP2-K63-400 400 Shark Tooth! | \$299.99  | \$285.99*       |

### IBM/Cyrix MII

Tiger recommends the AT motherboard or the Tiger Super Socket 7 motherboard with these processors.

| IBM/Cyrix MII          | 1-2 Units | 3 units or more |
|------------------------|-----------|-----------------|
| #CP2-6X300 MII 300 CPU | \$49.99   | \$46.99         |
| #CP2-6X333 MII 333 CPU | \$59.99   | \$56.99*        |
| #CP2-6X350 MII 350 CPU | \$94.99   | \$89.99*        |

## Intel Celeron & Pentium II MMX

### Intel Celeron & Pentium II Processors

|                                                             | 1-2 Units | 3 units or more |
|-------------------------------------------------------------|-----------|-----------------|
| #CP1-C1300A Intel Celeron 300A (128K cache) processor w/fan | \$74.99   | \$69.99         |
| #CP1-C1333 Intel Celeron 333 (128K cache) processor w/fan   | \$99.99   | \$94.99         |
| #CP2-P2-350 Intel Pentium II 350 processor No fan*          | \$209.99  | \$203.99        |
| #CP2-P2-400 Intel Pentium II 400 processor No fan*          | \$289.99  | \$279.99        |
| #CP2-P2-450 Intel Pentium II 450 processor NO fan*          | \$614.99  | \$596.99        |
| #CP2-P3-400 Intel Pentium III Katmai 400 processor No fan*  | \$549.99  | \$532.99        |
| #CP2-P3-500 Intel Pentium III Katmai 500 processor NO fan*  | \$769.99  | \$731.99        |

## 1.44MB 3.5" Drives

| Item #    | Description              | 1-2 Units | 3 Units |
|-----------|--------------------------|-----------|---------|
| S190-1002 | 3.5" 1.44MB Floppy Drive | \$17.99   | \$14.99 |

## Cooling Fan SALE!



| Item #    | Description    | 1-2 Units | 3 Units |
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| C183-1000 | Socket 7 Fan   | \$4.99    | \$3.99  |
| C183-1000 | Pentium II Fan | \$5.49    | \$4.99  |

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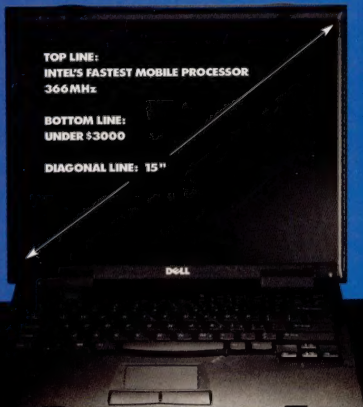
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